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Health Information System Development Plan for Egypt: Phase 1—HIS 2000

June 1999

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Partnerships for Health Reform

PHR

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Abstract

The Egyptian Ministry of Health and Population operates one of the largest rural health care systems in the world, accounting for roughly 20 percent of outpatient visits in the country. Other health care providers, including the Health Insurance Organization, Curative Care Organization, the new Family Health Fund, and the private sector account for most visits. Health sector reform is intended to decrease the role of the Ministry as a provider, while strengthening its role as a regulator. By late 1999 the Ministry still operated a core health information system (HIS) designed from the bottom up and covering only facilities operated by the Ministry. This system operated on an increasingly obsolete computing platform and lacked the capacity to incorporate data from other health care providers.

This report was developed to outline broad strategy, create a common vision for developing a new core health information system, and describe specific technical development tasks in detail. The new information system must be designed from the top down based on information demand. This should focus development on clear data collection and processing priorities, eliminate collection of unused data, and produce an efficient and relevant system. Information demand is being generated and defined by developing and testing an Executive Information System (EIS), beginning with a very limited set of key indicators and drawing data from the existing HIS. The list of indicators will change and expand as demand broadens.

As the EIS develops, the core HIS database will be redesigned on a new technical platform. The new design and technical platform should scale easily to accommodate data from other health care providers. Redesign will begin with the common dimensions of time, provider, facility, location, and higher order classifications of these dimensions. As information demand is defined through EIS development, the required data elements will be added to the new HIS design. The resulting system should streamline data collection and processing, incorporate data flows from other health care providers, and eliminate unused data elements.

This report describes long-term and short-term objectives. It includes a detailed technical assessment of existing HIS implementations, and technical alternatives for the computing platform. The strategy described in this report focuses on structural and technical improvements to the core information system database and data handling components. The report recognizes the significance of incorporating data from other health sector providers, but does not describe how this will be done. Specific technical development tasks and task teams are described in detail. The report includes a suggested development timeline, an inventory of existing related software applications, an inventory of current coding systems, an example framework for specifying field validation, and an example data collection and processing schedule.

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Acronyms

ASMO	Arabic Standards and Measurements Organization
BTS	Budget Tracking System
CAPMAS	Central Organization for Public Mobilization and Statistics
CCO	Curative Care Organization
CEAS	Cost Effectiveness Analysis System
DDM	Data for Decision Making Project
DOP	Directorate of Planning
DOS	Disk Operating System
DPS	Data Processing Systems
EIS	Executive Information System
FHF	Family Health Fund
FTE	Full-time Equivalent (equivalent to one full-time employee)
GB	Gigabyte
GOE	Government of Egypt
GUI	Graphical User Interface
HES	Health Economic System
HIC	Health Information Center
HIO	Health Insurance Organization
HIS	Health Information System
HDSS	Health Directorate Support Systems
HDSU	Health Directorate Support Unit
HMHC	Healthy Mother Healthy Child
IBM	International Business Machines
ICD	International Code for Disease
IDSC	Cabinet Information and Decision Support Unit
ISP	Internet Service Provider
IT	Information Technology
ITI	Information Technology Institute
LAN	Local Area Network
MB	Megabyte

MOE	Ministry of Education
MOHP	Ministry of Health and Population
MS	Microsoft
MSDE	Microsoft Data Engine
NGO	Non-Governmental Organization
NHA	National Health Accounts
NHIS	National Health Information System
NHS	National Hospital Survey
NICHP	National Information Center for Health and Population
NTL	National Technical Laboratory
PBS	Patient-Based System
PC	Personal Computer
PHR	Partnerships in Health Reform Project
ODBC	Open DataBase Connectivity
SIO	Social Insurance Organization
SQL	Structured Query Language
THIO	Teaching Hospitals and Institutions Organization
URC	University Research Co., LLC
USAID	United States Agency for International Development
VB	Visual Basic (Microsoft)
WHO	World Health Organization

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The author is grateful to His Excellency, Minister of Health and Population, Dr. Ismail Salaam, for his continued support for improving health information systems in Egypt. Dr. Tayseer El-Sawy, director general of the National Information Center for Health and Population (NICHP), has worked tirelessly to develop the NICHP and participated in many working sessions and informal discussions contributing to this report. Under Dr. Tayseer's leadership, NICHP technical staff developed some of the key recommendations in this document. Dr. Ibrahim Saleh, director general of the Directorate of Planning (DOP), has built on the work of the Data for Decision Making, continuing support for the Budget Tracking System and introducing new budgeting and tracking tools into the DOP. Les Fishbein, PHR health information system advisor in Egypt, has worked closely with His Excellency the Minister and with Dr. Tayseer and Dr. Saleh to significantly strengthen the capacity of the NICHP. The results are clearly evident to those who are familiar with previous administrations. The author is also grateful to the Technical Support Office (TSO) of the Ministry, particularly Dr. Mahmoud Abdel Latif for his efforts to radically simplify the Budget Tracking System. Finally, the author would like to thank the staff of the NICHP and the DOP for contributing to this report, for their continued hard work to improve the information systems of the Ministry, and for their friendship.

Executive Summary

The Egyptian Ministry of Health and Population operates one of the largest rural health care systems in the world, accounting for roughly 20 percent of outpatient visits in the country. Other health care providers, including the Health Insurance Organization, Curative Care Organization, the new Family Health Fund and the private sector account for most visits. Health sector reform is intended to decrease the role of the MOHP as a provider, while strengthening its role as a regulator. The Ministry still operates a core health information system (HIS) designed from the bottom up and covering only facilities operated by the Ministry. This system operates on an increasingly obsolete computing platform and lacks the capacity to incorporate data from other health care providers. The HIS needs to be redesigned to meet the current and anticipated needs of the MOHP. The new HIS must be able to integrate data from other health care providers.

An Executive Information System (EIS) has been constructed to display a limited number of key indicators. The EIS draws data from the existing HIS. Information demand should be developed and defined through EIS development. The number and type of indicators, dimensions, and displays in the EIS should increase as information demand is defined at each decision-making level of the MOHP. The new HIS should be designed to meet the needs of the EIS as it develops. This will limit data collection and processing at each level to only that data needed for decision makers at each level. This should eliminate collection and processing of unused data and produce a much more efficient system.

Neither the existing FoxPro HIS nor the Cabinet Information and Decision Support Unit (IDSC)-designed HIS meet the new needs of the MOHP. The FoxPro HIS is now operating on an increasingly obsolete computing platform. Though the IDSC-designed product includes some technical improvements, both versions were not designed to meet well-defined information demands, to accommodate financial data, or to accommodate data from multiple health care providers. The HIS database should be completely redesigned, beginning with the basic elements of time, facility, provider, location, and related classifications. The addition of data elements to this design should be guided strictly by the data required by the new EIS as it is implemented and enhanced. As this new design develops, mechanisms should be designed to incorporate required data flows from collateral systems, particularly patient encounter systems such as the Patient-Base System or PBS.

The new design should not be designed to serve the purposes of personnel/payroll, drug inventory, patient encounter, or other facility management systems. Instead it should be designed to meet the needs of high-level decision makers, relying on separate manual or automated facility management systems to provide only the data needed to produce indicators required by the EIS.

The new system should take advantage of new capacity, performance, stability, and scalability improvements in the new MSDE database engine included with MS Access 2000. This will allow National Information Center for Health and Population (NICHP) staff to use existing skills in Access while allowing smooth migration to MS SQL Server 7 at the central and even health directorate levels as the necessary technical capacity develops. The NICHP should migrate to MS SQL Server 7 at the earliest possible stage of development. Many PCs in governorate health directorates may need to be upgraded or replaced to support MS Access 2000.

The database design team should focus on creating a new, fully normalized relational structure to meet the current needs of the MOHP without referring to the previous HIS structure. The new design should completely specify relational integrity.

As the new database is developed, separate teams are needed to carefully specify data validation and standard coding systems. Separate teams are also needed to develop automated procedures to transfer data from the existing HIS, and to automate secure data management procedures.

The new HIS should be designed, developed, tested, and implemented incrementally. New data entry screens, data entry forms, quality control procedures, and management reports should be created and introduced to governorate health information centers as they are needed. The transition from the existing FoxPro HIS should therefore be gradual, and fully integrated with the ongoing work of the Health Directorate Support Unit.

1. Introduction

This plan lays out the first phase of a health information system (HIS) for the Egyptian health care system. Its intention is development of a common vision, sense of direction, and forward momentum. It concentrates on consolidating and advancing existing components of an HIS. Critical elements are missing, but are identified. Despite best efforts, the plan surely contains inaccuracies. The author apologizes for these in advance and hopes this document is constructive despite its flaws.

2. Objectives

2.1 Long-term

Long-term objectives of the National Health Information System (NHIS) for Egypt are as follows:

1. A reliable, efficient, and sustainable system to produce information needed to monitor and manage Ministry of Health and Population (MOHP) programs, health care facilities, and to evaluate policies that affect the health care system.

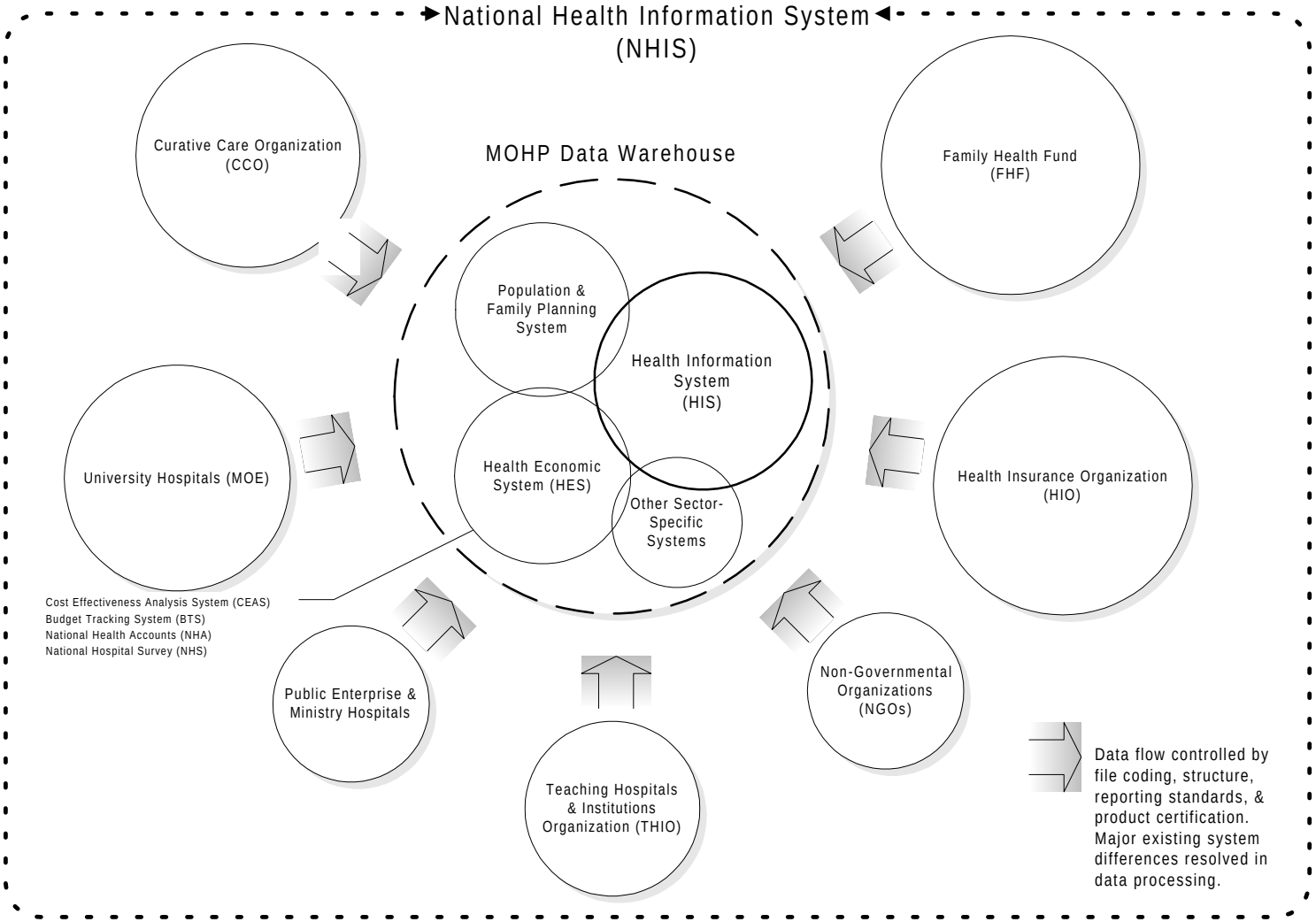
2. A reliable, efficient, and sustainable system to monitor health services outside the immediate control of the MOHP, including the Health Insurance Organization (HIO), Curative Care Organization (CCO), Teaching Hospitals and Institutions Organization (THIO), and private clinics and pharmacies receiving government payments for delivery of services.

The development plan described in this document is only the first step towards building an NHIS that provides vital information about all sectors of the health care system, including the HIO, CCO, THIO, and other sources. The NHIS will be built on the foundation of the existing HIS and overseen by the National Information Center for Health and Population (NICHP). This document addresses short-term and medium-term plans to improve data quality control and compliance, strengthen HIS database structure, move databases and software to modern, scalable information technologies (IT), and continue to strengthen the role of governorate health information centers (HICs) in data collection, quality control, processing, and management. The resulting system is referred to as "HIS 2000."

Both long-term objectives listed above should be kept in mind while developing HIS 2000. Achieving the first objective will provide the MOHP with information needed to manage its facilities effectively. This is the primary focus of the plan described in this document. However, HIS 2000 should be the foundation for a system providing vital information on all components of the health care system, not just facilities under the direct management of the MOHP. These include hospitals and clinics managed by the HIO, CCO, other government ministries (e.g., Defense), public enterprises (e.g., Egypt Air), and teaching hospitals and institutes, as well as other health care providers, including the Family Health Fund and private clinics and pharmacies receiving government payments for delivery of services. Development of data coding and database standards for HIS 2000 should be done considering the need to integrate information from other parts of the health care system. Figure 1 is a conceptual diagram showing major components of the eventual Egyptian NHIS.

In addition to the specific tasks outlined in this document, a significant effort should be made to identify the minimum information needed from all the health care providers mentioned above. This element is critical and the NICHP needs to develop a strategy for addressing it in 1999.

Figure 1. A Conceptual Diagram of National Health Information System Data Sources



2.2 Short-term

Short-term objectives are as follows:

1. Integrate HIS and Health Economic System (HES) (Budget Tracking System [BTS], Cost Effectiveness Analysis System, etc.) data requirements into a single data collection, processing, and reporting system.

2. Improve data quality control and management.

3. Establish clear data coding standards for the MOHP

4. Strengthen database structures through sound engineering so the system can be expanded without breaking.

5. Move databases and software to a modern platform with a better future and a common Arabic code page.

6. Produce an Executive Information System (EIS) for top-level MOHP decision makers that displays useful indicators from reliable, routinely updated data.

Short-term objectives 1 and 6 are important benchmarks for the MOHP and must be achieved by the end of 1999.

Table 1 combines draft calendar 1999 benchmarks with other information system development objectives. These are divided into three categories: short-term objectives to be achieved by the end of calendar 1999, medium-term objectives to be achieved by the end of September 2000, and longer-term objectives.

Table 1. Objectives for Information System Development

Short-term Objectives (End of calendar 1999)	Medium-term Objectives (End of September 2000)	Long-term Objectives
▲ Improve data quality control ▲ Establish standard coding systems for all key data elements ▲ Develop HIS database design considering requirements of all sectors ▲ Integrate BTS with HIS ▲ Begin developing the next version of the HIS on modern scalable IT platform ▲ Produce working EIS for priority indicators for use by top-level MOHP decision makers	▲ Complete transition from the current HIS (FoxPro HIS) to the new HIS (HIS 2000) ▲ Monthly data consolidation and reporting in governorate health directorates ▲ EIS developed for and used in governorate health directorates	▲ Introduce hospital management systems in all MOHP hospitals ▲ Routine reporting of data from HIO and CCO ▲ National Cancer Registry

While working to achieve the objectives listed in Table 1, the focus should be on producing reliable monthly indicators reporting at the central MOHP headquarters and governorate health directorate levels. Key indicators derived from current HIS data collection were developed[1] and separated into three different phases. Phase 1 indicators are listed in Table 2. This list is preliminary and is expected to change somewhat.

Table 2. Phase 1 Indicators from Existing HIS and BTS Data

Category	Indicator	Benchmark or Reference
Expenditures	Primary Health Care Expenditures (MOHP only)	Primary health care expenditures / Total expenditures (MOHP facilities and central administration)
Public Health	Endemic Disease Distribution	New cases of each disease / Total new cases
	Bilharzia Incidence Among Tested	Positive tests / Total tests
Maternal and Child Health	Infant Mortality Rate	Infant deaths / 1000 live births
	Maternal Mortality Rate	Maternal deaths / 1 million live births
	Average Antenatal Visits	Total antenatal visits / New visits
Preventive Care	Infant Immunization	Number of Infants fully immunized
	Infectious Disease Distribution	New cases of each disease / Total new cases
Population and Fertility	Couple Years of Protection	
Curative Care	Doctor Case Load	Number of outpatient visits / Full-time equivalent (FTE) doctor / Day
	Emergency Case Load	Number of emergency visits / Total outpatient visits
	Whole Blood Expended	Whole blood expended / All blood products expended
Infrastructure	Primary Care Facility Patient Load	Estimated total population / Number of primary care facilities
Family Health	Length of Outpatient Visits	Number of outpatient visits of specified length of time / Total outpatient visits
	Doctor Case Load	Average number of outpatient visits / FTE doctor / Day

The objective is to produce fixed graphical and tabular displays of Phase 1 indicators monthly, and to implement Phase 2 and Phase 3 indicator displays as rapidly as possible. These displays should be available through the MOHP network and on stand-alone PCs. The indicators to be produced are certainly not limited to those in Table 2. Producing useful indicators from available data will help build and focus user demand. At the same time, work should proceed to define other indicators for monitoring health sector reform and built them into the HIS.

Phase 1 indicators were selected because they are fundamental and available through current HIS data collection, not because they are the most important and useful indicators. It is important to add

[1] Gaumer, Gary. 1998. *Assessment and Development of the Egyptian Ministry of Health and Population Information Systems, May 17–June 5, 1998.* Bethesda, MD: Partnerships for Health Reform, Abt Associates Inc.

other more useful indicators as rapidly as possible. Indicators necessary to monitor the effectiveness of health reform are most important. This should be a key consideration in reviewing data requirements for HIS 2000 and beyond

3. Technical Assessment

This section reviews the current status of the existing health information system and related coding systems. There are now two different versions of the HIS. A third version will be developed using the best aspects of the existing two. The following terminology is used in the remainder of this document:

- "FoxPro HIS" refers to the existing FoxPro/DOS-based health information system.
- "HIS-IDSC" refers to the new version of the HIS developed by the Cabinet Information and Decision Support Center (IDSC) using Microsoft Access 97 and Visual Basic 5. This version has just been completed and has not been tested or deployed by the NICHP.
- "HIS 2000" refers to the next version of the HIS to be developed.

Annex A contains an updated inventory of software applications than may be of some use in an integrated information system. Most of these applications are unchanged since the assessment conducted by the author in January 1998. There have been several additions. Table 3 is an updated summary classification prepared by Partnerships for Health Reform (PHR) long-term technical advisor Les Fishbein that categorizes these applications by current organizational home. Applications controlled by the Health Insurance Organization and Curative Care Organization are of less immediate interest. They will be more difficult to affect and are less likely to produce valuable results quickly without major investments. Applications listed for the NICHP and Directorate of Planning (DOP) are of direct interest because the are within the immediate domain of the MOHP.

3.1 Health Information System

Assessments by Cressman, Atkinson, Gaumer, and Lal concluded that the current HIS is the best basis from which to build the much broader HIS envisioned by PHR and the NICHP. There are currently two versions of the HIS. The FoxPro HIS has been in use for some time. HIS-IDSC, developed by IDSC, has been designed to replace the FoxPro version.

3.1.1 FoxPro HIS

This system is tested and has been in operation for almost three years. It is in use in all 27 governorates. Data is currently collected from individual facilities on paper forms. Between 22 and 27 forms are being completed and entered in each governorate. These forms are distributed annually and monthly by the health information center in each governorate health directorate. Each directorate's health information center collects the completed forms, then enters the data on one or more PCs. Only a few governorate health directorates have networked their PCs. The FoxPro application was not designed to support multiple users. Data is sent to the NICHP on diskettes. Some governorate health directorates do not consolidate their data into a single database, but send separate data files to the NICHP for consolidation there. These governorate health directorates do not have access to their own consolidated results until the NICHP processes their data.

Table 3. Summary Inventory and Classification of Public Health System Software Applications

No.	NICHP	No.	DOP	No.	HIO/MAXIMUS	No.	CCO
1	Biomedical Equipment, Assets, Preventive and Corrective Maintenance	20	CEAS: Building	30	Cost Accounting		
2	Personnel/Payroll	21	CEAS: Drugs	31	Medical Quality Assurance	40	DPS: Drug Inventory Control
3	Material Management (drugs, medical supplies, spare parts)	22	CEAS: Equipment	32	Drug Control		
4	Blood Bank	23	CEAS: Personnel/Payroll	33	Contracted Pharmacy		
5	Training Administration	24	CEAS: Personnel/Payroll	34	Contracted Providers		
6	Operating Theatre (OTS)	24	CEAS: Utilities	35	Management Reporting		
7	Fixed Assets	25	CEAS: Activities	36	Periodic Medical Examination		
8	Open Heart, Kidney dialysis and Patient Treatment	26	BTS	37	Admission/Discharge/ Transfer		
9	Medical Records	27	DPS: Personnel/Payroll	38	Patient Records		
10	HIS Reporting System	28	DPS: General Accounting	39	Beneficiary Registration		
11	National Pharmaceutical Database	29	DPS: Drug Inventory Control				
12	Bibliographies						
13	Doctors Recruitment						
14	Addiction						
15	Patient Based System (PBS)						
16	Family Folder						
17	ICD9 Tutorial						
18	Pharmacy						
19	Health Information System (HIS)						

Monthly data production in each HIC ranges from about 1.2MB to 8MB (Dakahlia). One year of HIS data from Dakahlia occupies four 1.44MB diskettes in compressed form. Data from all HICs for the last year totals 221MB uncompressed. Adding BTS expenditure data to HIS data collection is estimated to add from 1MB to 17MB of data annually in each governorate.

The volume of data entry in several governorates may require additional data entry operators, or decentralizing data entry to the district level. John Snow, Inc., under the Healthy Mother Healthy

Child Results Package, is testing data entry at the district level in three governorates in upper Egypt (Beni Suef, Luxor, Aswan). Their reports document infrastructure and human resource constraints, and specify district-level responsibilities for data collection and entry.

The current HIS is built on 95 FoxPro tables. In a strict sense the system is not a relational database, but it is well designed. Documentation exists in English and Arabic. At higher conceptual and technical levels system documentation is good. Technical documentation of the database and software architecture is weak or nonexistent.

The system is divided into control tables, which document the system and provide important management information to the software, coding tables, and data tables. Some key code tables contain Arabic labels only, but coding for most fields, forms, and reports is available in Arabic and English in one of several control tables. A single control table is used to provide Arabic or English text for most coded fields. Most data tables are related to a specific data entry form. Complex forms are divided into two or more data tables. The system has been integrated with a GIS system for simple thematic mapping.

Lookup tables are used to validate some fields during data entry. Validation of other fields is not well documented. There are persistent data quality problems, some of which could be addressed in the database structure and data entry software. Data entered on several PCs in the same governorate are consolidated by the NICHP Health Directorate Support Systems (HDSS) unit, not in the governorate HIC. There are problems with data consolidation.

Some coding systems come from official organizations (Central Organization for Public Mobilization and Statistics [CAPMAS], World Health Organization [WHO]). Others were created by the HIS development team. Some codes for forms not yet used still need to be defined. Code tables, including facility codes, are maintained at the NICHP. Updated code tables are delivered to the governorate health directorates on diskettes when opportunity allows.

The existing FoxPro HIS is well structured and documented. However the supporting database system does not have a bright future. A current Windows-based version is supported by Microsoft, but differs substantially from the MS-DOS version currently supporting the HIS. Microsoft is clearly focusing on its Access and Structured Query Language (SQL) Server product lines, and states that it is moving towards a single database engine, based on SQL Server, across all its database products. Developers are wise to move new development to Access for stand-alone and small workgroup databases and SQL Server for larger, higher transaction volume databases. Though an excellent piece of work, the existing FoxPro system could be improved in the following areas:

- Normalization of the database to improve flexibility and performance;
- Relations and referential integrity rules maintained by the database engine;
- More complete validation for data entry;
- Field validation rules maintained by the database engine; and
- Conversion of text data to Windows Arabic or Unicode coding systems.

These improvements can be made while moving the system to a relational database running under the Windows 95/98/NT operating system. The objective should be a sound database structure that can scale up easily to a relational database server, such as Microsoft SQL Server. While moving

to a relational database, the best aspects of the FoxPro system design should be retained. These include consistent, well documented naming systems for tables and fields, selected coding systems from national and international authorities, coding systems developed expressly for the HIS, control files documenting most of the structure, and Arabic and English text for most important elements.

3.1.2 IDSC HIS

The Microsoft Access 97 implementation is divided into nine linked databases. Tables have been assigned to the various databases as follows:

- Common codes (country, governorate, district, facility, drug, vaccine, etc.)
- Infrastructure
- Curative health care
- Preventive health care
- Tropical disease
- Location

The IDSC has done a good job translating the FoxPro table structure into a more normal relational form. The staff have also resolved several awkward aspects of the original design. For example, they have separated the composite facility code into a nationally unique facility identifier, and a separate facility type code. They have also designed a hierarchical system for encoding location facility locations. A control database contains tables with some information about tables, fields, and labeling information in Arabic and English, and tracking information for code maintenance.

Almost no table relations are defined in the database, and no referential integrity has been specified in the structure. The database contains essentially no field-level or record-level validation information. These are critical elements that must be developed. Table and field names are generally more descriptive of contents and more consistent than the system used in the FoxPro HIS, but there are still some naming inconsistencies. Referential integrity, field and record validation rules, and naming consistency must be developed if this database design is to serve as the foundation of the National Health Information System.

The Access version has a Visual Basic 5 user interface. Several problems were encountered testing the software, but it appears very nicely done and demonstrates some skill in graphical user interface design. We reached an agreement in principle for the IDSC programmer to work with the MOHP on-site to develop the next version. The objectives are to reduce development time, produce a better product, and remain positively engaged with the IDSC. IDSC support is badly needed to help HIS efforts in the governorates.

The new version of the HIS developed by IDSC is a step in the right direction. The database is more normalized and is managed by a relational database engine (Jet) in Microsoft Access. The user interface is graphical and runs under Windows 95/98/NT. The user interface has been developed using Microsoft Visual Basic (VB), allowing it to be distributed in tokenized or compiled form. Though users have not yet tested it, the user interface is a visually impressive piece of programming.

A large local population of Visual Basic programmers improves sustainability. However, this version can also be improved.

The IDSC product does not define table relationships in the Access database. Instead, they are maintained only by the VB code. Relational integrity therefore depends on the skill of the programmer. Field-level validation in the user interface is weak, and no field-level validation is defined in the database itself. Hence the ability of the database to preserve relational integrity and control basic data validation is not being used. Nothing would be gained by upsizing this design to SQL Server, and deploying this product would not improve existing data quality control. These problems need to be resolved before this database is deployed or moved to a relational database server.

3.2 Health Economic System

The HES is a collection of several separate, but related, systems for evaluating the allocation of expenditures and cost effectiveness of facilities and services. These systems have been developed and maintained by the Directorate of Planning. The major components are as follows:

- Cost Effectiveness Analysis System
- Budget Tracking System
- National Health Accounts
- National Hospital Survey

These components were built to automate methodologies introduced during the Data for Decision-Making Project (DDM). CEAS, BTS, and NHA are designed to produce annual results. The BTS requires expenditure data by facility, while the CEAS requires expenditure data by department within each facility, and applies primarily to hospitals. The DOP designed the NHS to be conducted every two years. In addition to the systems listed above, the DOP has also developed systems for planning, allocating, and monitoring investment funds (Bab III), and monitoring public works contractors.

HES component systems are implemented using a variety of spreadsheet and database applications. Most spreadsheet applications were developed using Quattro Pro, though DOP personnel also use Microsoft Excel. Database applications have been developed using Microsoft Access.

HES components share some data requirements and share many coding systems and basic information requirements with the HIS. In some cases data can be produced in the format required by the HES by adding tables to the HIS structure. Queries can be used to extract information in the required formats for further analyses using spreadsheets and other software.

3.3 Other Information Systems

There are information systems within the MOHP other than the HIS. These include population and family planning information systems, a pharmaceutical database, a patient-based clinical records system, a tuberculosis monitoring system, and others. There are some connections between the

pharmaceutical database and patient-based systems. It is not clear whether efforts have begun to coordinate these other systems with development of the National Health Information System.

The pharmaceutical database and patient-based system were developed within the NICHP; their structure, data requirements, and outputs are known. The NICHP needs this information about other applications in the MOHP also to help guide NHIS design and system integration. The NICHP needs to find a way to coordinate development of these systems.

3.4 Coding Systems

The NICHP does not yet have a clear set of official coding systems. Developing, documenting, promoting, and maintaining these coding systems is essential. Without them, it will be difficult to integrate data from different subsystems within the MOHP. It will also make it difficult to integrate data from external health care providers (HIO, CCO, THIO, private clinics and pharmacies, etc.) that provide the majority of outpatient care. As Egypt continues to depend increasingly on contracted private sector providers, the ability to receive, integrate, analyze, and act on critical data concerning public health, service delivery, and provider performance will determine whether the MOHP can serve as an effective custodian of public health care after the sector reform.

Annex B presents the results of a current analysis of key coding systems. This can be used to build a clear set of coding standards, to specify how those standards are maintained and distributed, and to document those standards. The analysis shows variations in coding among various versions of the HIS and related applications and that some coding systems still need to be defined. Responsibilities for maintaining and distributing codes have not yet been assigned.

A team should be formed within the NICHP to use the information in Annex B to develop a clear coding system for the NHIS and a program to institutionalize this system

3.5 Software Platform

3.5.1 Database Engine

The Cabinet IDSC intended the Microsoft Access version of the HIS to be used on stand-alone PCs in governorate health information centers. With a little care in programming, the application could be run safely as a multi-user application on a small network. There are some concerns, however, that Microsoft Access would not be capable of managing the quantity of data expected in a few large governorates (Alexandria, Dakahlia), or the consolidated central database. The IDSC assumed therefore that the NICHP would import results into Microsoft SQL Server or Oracle to allow secure network management of large quantities of data. Microsoft SQL Server 7 has been installed on the NICHP server, but no work has been done yet to develop systems for evaluating and consolidating data from governorate HICs into a SQL Server 7 database.

Performance and stability are concerns with very large Access databases. Access is a file-server database engine. The PC client does all data processing. The database can be shared securely, but each PC client is responsible for doing its own data processing. Coordination among clients is managed through a single shared file. Developers consider Access reliable for small- and medium-size databases with a few simultaneous users. Beyond a certain capacity, level of complexity, and number of users, however developers are advised to move to a relational database server, such as MS

SQL Server, Oracle, Sybase, or IBM DB2. These systems perform all data processing on a network server in response to requests from multiple clients.

In Egypt, depending on the level of disaggregation, the number of records expected in some governorates could be a problem for Microsoft Access. For example, an Access-based patient recordkeeping system in Shark El Medina Hospital in Alexandria experienced severe performance problems with more than 300K records. Several design changes were made to improve performance.

Microsoft Access 2000 is scheduled for release in May 1999, with Office 2000 Professional. Beta versions have been available for some time. The Access 2000 file format differs from the Access 97 format, primarily in its complete support of Unicode, a single multiple language character code page. Microsoft provides a database conversion utility. It is still not known how well this utility will work on the NHIS until it is tested on HIS databases.

Access 2000 offers two alternate database engines: Jet, which is the engine used by Access 97, and the Microsoft Data Engine (MSDE). Jet 3.51, the default engine for Access 2000, includes enhancements that should improve performance and reliability for multi-user applications. Technically the Jet engine supports up to 255 users and 2GB of data. In reality, the limits are much lower. Microsoft recommends using the Jet engine only for databases less than 50MB in size. MSDE is based on the Microsoft SQL Server 7 database engine, and provides improved compatibility with SQL Server 7. MSDE is a client-server engine, providing better reliability, security, and performance than Jet. Though MSDE is also technically limited to 2GB databases, it is capable of managing databases that size. The next version of the HIS should be moved to Access 2000 and the MSDE as early as possible. This should improve scalability considerably.

The most important task is to design a sound relational database structure for the existing HIS. This structure should incorporate as complete a specification of table relationships, data initialization, and data validation as possible. These specifications in the database will help protect the integrity of the database and improve the quality of the data. It is not a substitute for good quality control procedures, but is an important element in a complete quality control system. Using automated tools, this structure, including data and data integrity and validation rules, can be moved to a relational database engine, such as MS SQL Server.

3.5.2 Arabic Support

Microsoft Office 2000 includes Unicode support in all applications, and includes the MultiLanguage Pack for the first time. This makes it possible to enter, display, and edit text in Arabic using the same version of the product sold anywhere in the world. This allows applications to be developed with Arabic displays, but does not mean the user interfaces for Office applications, such as Excel, are in Arabic. An Arabic interface version of the product should be available within the next six to eight months. This timing should not delay NHIS development because an Arabic interface in the base product is not necessary for NICHP developers. Work can proceed using existing tools. It should be possible to begin testing and development in the current version. Office 2000 Professional with Arabic support should be available just about the time it is needed.

3.5.3 Data Entry Interface

The current IDSC user interface is developed using Microsoft Visual Basic. Visual Basic produces a compiled or tokenized program that is easy to distribute and difficult for end users to

modify. Commercial utilities make it easy to produce a program that anyone can use to install all components necessary to run a Visual Basic application. The existing IDSC Visual Basic application can be modified to conform to changes and improvements in the HIS database. If designed correctly, a Visual Basic application can use data from any one of many database products with few or no internal changes. Reports available through the IDSC application have been created using Crystal Reports for Visual Basic. This is a very popular and powerful reporting tool, but requires an additional skill.

Access applications are relatively easy to develop and easy to modify. Since a capable report engine is part of Access, it is easy to change or add reports. Access applications can be distributed with a run-time version of Access, and can be distributed in encrypted form. The capacity and multi-user limitations of Access can be resolved by upsizing Access databases to Microsoft SQL Server. The resulting databases can be linked to an Access-based user interface. Access applications depend on Microsoft Access, which has been more susceptible to compatibility problems between versions than Visual Basic. While it is relatively easy to produce applications using Microsoft Access only, it was never intended to produce mission critical applications that are distributed to many users. The same is true of the Jet database engine used by Access. Unfortunately, because it is so easy to use, it is often used for applications that strain its data handling capabilities.

Few NICHP staff have skills in Visual Basic but many have the aptitude to learn and apply this tool. Many NICHP staff are skilled in developing Microsoft Access applications and will be able to produce a usable product in less time using Microsoft Access. They will need at least one week of training in Visual Basic before starting to use it. Those with some higher level programming experience are likely to adapt to Visual Basic quickly. Building these skills will benefit the NICHP in other areas. For example, the Microsoft Excel-based Executive Information System also uses Visual Basic, and will require some Visual Basic skills. Microsoft Word also uses Visual Basic for automation. Microsoft Active Server Pages, a technology for connecting Web pages to databases, also uses Visual Basic technology. An investment in building Visual Basic skills will pay off.

The existing FoxPro application uses a character-based user interface running under MS-DOS. The IDSC application uses a GUI and runs under Windows 95/98/NT. Users have not yet tested it. It is likely data entry speed will be reduced significantly when moving from a character to a graphical user interface. Adjustments make the GUI more like its predecessor, reducing retraining and improving data entry speed. This is important; data entry speed is already an issue in many governorates. Increasing the amount of data entered in governorate health directorates, while introducing a new user interface, is certainly going to increase the time it takes to enter data. Users should test the new user interface as soon as possible and adjustments should be made to increase data entry speed.

3.5.4 Routine Management Reporting

The FoxPro HIS includes a large number or routine management reports. Many of these reports have been reproduced in HIS-IDSC using Crystal Reports for Visual Basic. This is an appropriate combination that can continue to be used. Crystal Reports can also be used with most relational databases, and can even be used for Web-based reporting. Management reports can also be produced using MS Access 2000, whether the database remains in Access or is upsized to MS SQL Server.

3.5.5 Executive Management Reporting

An Intranet Web-based Executive Information System should prove very effective in delivering NHIS results to MOHP decision makers via the MOHP LAN. However, developing this kind of system takes technical skill and time. Displays of high priority indicators are needed now, centrally and in governorate health directorates. In addition, governorate health directorates do not have the telecommunications needed to use such a system. Most computers in governorate health directorates are not networked and do not have access to the Internet. In the future, the MOHP could provide secure dial-in access. It may also be possible for governorate health directorates to obtain local dial-in access through governorate information centers. Until then, governorate health directorates need a stand-alone application to present current HIS results. It should possible to distribute this application and data updates on diskettes. Until similar capabilities are available via an MOHP Intranet Web site, it should be possible to use the same application to present national HIS results to MOHP decision makers.

An EIS for use in governorate health directorates needs to display cross-sectional and time-series results for individual facilities within the governorate, and it needs to compare facilities and districts. An EIS for use in the MOHP also needs to display cross-sectional and time series results for individual facilities, but in addition it needs to display consolidated national results and compare facilities, districts, and governorates. These two different versions can be built on the same base.

The MS Excel-based EIS developed under DDM can provide the foundation. It can be modified to display high-priority indicators using data from the existing FoxPro HIS. It can be modified easily to adapt to changes in the HIS database. The necessary skills consist of familiarity with Excel, basic Structured Query Language, and Visual Basic.

Transferring and extending the DDM EIS technology can begin now, in parallel with other HIS 2000 development tasks. Efforts should focus on producing useful information displays from existing FoxPro HIS results before the end of 1999.

3.5.6 Transmission of Data

Governorate health directorates currently deliver data to the NICHP on diskettes. This system can continue until electronic data transfer begins. Electronic transfer requires two elements: a reliable telecommunications medium, and a secure and reliable way to manage and control data transmission.

There are several possibilities for electronic data transfer between governorate health directorates and the NICHP. These include the following:

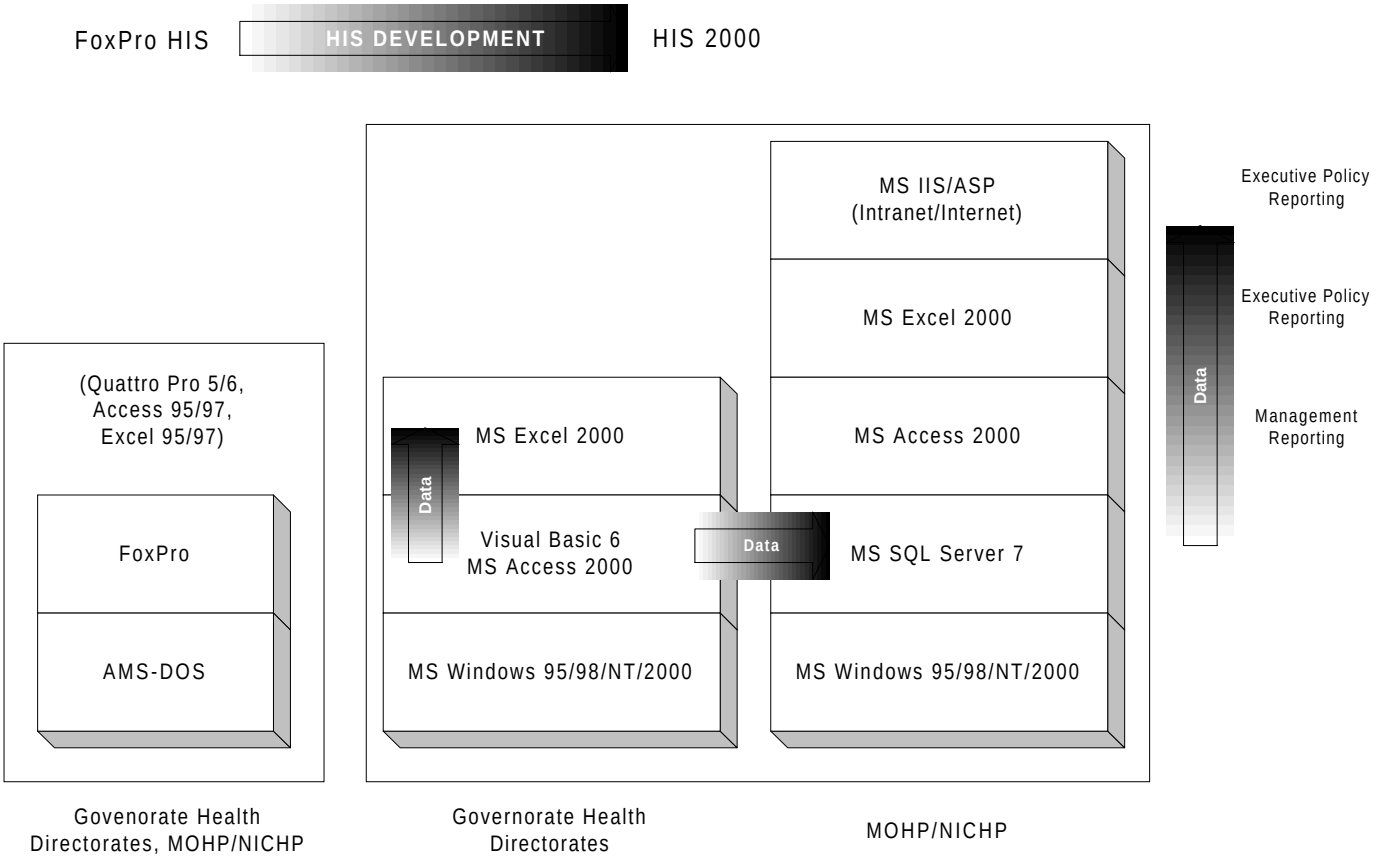
- Commercial Internet Service Providers in some governorates.
- Dial-up access to governorate information centers, many of which have leased line or VSAT Internet access.
- The new emergency services communication network built by the MOHP for dispatching emergency services.
- Direct dial-up to the NICHP.

These options and others are being investigated. None of the more technologically advanced solutions are likely to be available in all governorate health directorates. Therefore it is important to develop a data transmission control system that can be adapted easily to any of the various transmission options. Mature commercial software is available for this purpose. The NICHP now has the leading software package in this area and is preparing to test it for dial-up transmissions over normal telephone lines. Updated code tables can be retrieved from the NICHP at the same time new data are transmitted to the NICHP.

3.5.7 Summary

Figure 2 summarizes the development of the proposed software platform. As indicated, the current FoxPro HIS is a non-relational file-server database application developed using FoxPro only. HIS-IDSC, developed by the IDSC at the request of the HIS team, is a relational file-server application constructed using Microsoft Access 97, Visual Basic, and Crystal Reports. The current EIS application was developed using Excel 95/97. The HIS 2000 database is to be developed using the new Access 2000 MSDE engine for governorate health directorates, and SQL Server 7 for the MOHP. The data entry user interface and reporting are likely to be constructed using the HIS-IDSC foundation in Visual Basic and Crystal Reports. The EIS is likely to be moved to Excel 2000 while it is modified to first use FoxPro HIS data, then HIS 2000 data when it becomes available.

Figure 2. Development of the Proposed HIS 2000 Software Platform



3.6 Hardware Platform

3.6.1 Governorate Health Directorates

PCs in governorate heath directorates are running Microsoft Windows 95/98, Microsoft Office 95, FoxPro 2.0, dBase IV, and other applications. Some governorate health directorates have developed their own reports using Microsoft Access 97. A few have developed their own Visual Basic applications.

Governorate health directorates are currently equipped with Intel 80486 and Pentium PCs with 16MB to 32MB of memory and hard disks ranging in size from 450MB to 4.5GB. Only a few governorate health directorates have installed small computer networks. The Health Directorate Support Unit of the NICHP has a current inventory of this equipment. Most of this equipment is adequate for current applications.

The number and specification of PCs need to be assessed carefully with respect to an estimate of HIS 2000 requirements. Table 4 compares the resource requirements of Office 97 and Office 2000. Microsoft Office 2000 requires more capacity in every area. However, Office 2000 is now the current version and has a longer expected lifespan. It also provides better language support in every module. Finally, the optional MSDE data engine should provide much better performance, reliability, and scalability. HIS 2000 development should anticipate the need to upgrade or replace computers in the governorate health directorates to support the selected software platform.

Table 4. A Comparison of Microsoft Office 97 and Microsoft Office 2000 System Requirements

Component	Microsoft Office 97 Professional	Microsoft Office 2000 Professional
Processor	80486 33MHz (66MHz)	Pentium 75MHz (133MHz)
Memory	16MB (32MB)	32MB (64MB)
Disk Space	73MB – 191MB (121MB)	217MB – 391MB
Other		CD-ROM Drive

Note: Figures in parentheses are considered more typical or practical.

The number of PCs needed in each governorate health directorate depends primarily on the amount of data that needs to be entered in the health information center or district offices. This depends on the number of and type of forms that must be entered monthly and annually, and the average amount of time it takes to enter the data for each type of form. Different forms are filled in each facility monthly and annually, depending on the type of facility. Therefore it is possible to estimate the total amount of time it may take to enter data in each district and governorate health directorate, according to the number of data entry personnel. A database model to produce these estimates already been developed.

To date there has been no consideration of using scannable forms in health directorates. Use of scanning technology could reduce data entry time significantly, particularly when combined with forms preprinted with identifying codes. Scanners would need to be maintained, and operators would still need to verify the results of the scanning software. However, this technology should be investigated to determine whether it might be appropriate. Because it requires additional hardware

and software components and operator skills, scanning should be pilot-tested before making any major investment in this technology.

Reducing the amount of data that must be entered, preprinting identifying information on forms, and increasing the number of data entry personnel may also decrease the amount of time it takes to enter the data. Once forms have been redesigned, it will be possible to estimate the number of data entry personnel needed in each governorate health directorate and to anticipate the need for more PCs. The same method can be used to estimate capacity needed for printing data collection forms and routine management reports. Additional PCs may also be needed for key decision makers.

Many computers in governorate health directorates do not have the capacity required by the anticipated computing platform. Additional PCs and printers may be needed. Microsoft Office 2000, and perhaps other software, will also need to be provided to governorate health directorates. It can easily take as long as eight months to procure computing equipment according to USAID regulations. A procurement and installation plan is needed to make sure necessary computing capability is in place when needed. This should be based on estimates of the necessary computing capacity, number of PCs, and the HIS 2000 development plan.

3.6.2 MOHP Headquarters

The NICHP is equipped with a new, structured, Ethernet network. Most PCs in the NICHP are connected to this network. A well-equipped Windows NT network server has been installed and is being configured as an e-mail, database, and Intranet Web server. The NICHP expects to add servers to this network, and has a plan for expanding the network to other buildings within the central compound soon. PCs in the NICHP are running Microsoft Windows 95/98 Arabic, Microsoft Office 97 Arabic, and a wide variety of other applications.

The new NICHP is well structured and is likely to have enough capacity for the anticipated applications. The network can be expanded easily to add PC workstations, and to provide access in other nearby buildings. Capacity can also be added to the network server, and servers can be added to the network. However, data storage capacity estimates need to be developed to anticipate the need for more disk and backup capacity. At some point e-mail, Web, and perhaps file and print servers will need to be moved to separate servers to improve performance.

4. Strategy

This report describes a plan to do the following:

- Integrate health information system and health economics system requirements into a single data collection and reporting system.
- Update the information systems engineering and information technology platform to support a significantly larger, more complex, and more adaptable HIS.
- Produce a functioning executive reporting system to help decision makers interpret HIS results, and to help the NICHP concentrate on producing the most useful indicators in the most effective way.

As illustrated by Figure 1, the HIS is a small part of the complete NHIS picture. To complete the picture, we need to add information on expenditures and information from other health care providers.

4.1 Missing Elements

4.1.1.1 Other Health Care Providers

The HIS was originally designed to monitor maternal and child health care provided through MOHP facilities in the governorate health directorates. This limited objective was expanded during the design phase to try to provide the MOHP with more information about facilities, personnel, and health care services in MOHP facilities. The DDM project helped to add expenditure information. Many capable people worked hard to produce this system and get it working. However, this system was designed before the beginning of MOHP health sector reform.

The health sector reform effort, lead by the minister of health, envisions significant changes in the role of the MOHP. The number and types of health care facilities directly operated by the MOHP may change. The MOHP will be responsible for accrediting health care providers reimbursed in part through a public health insurance system directly managed by the Family Health Fund (FHF). The Family Health Fund will be responsible for monitoring the efficiency and effectiveness of these providers. Without the information necessary to determine whether approved services have been provided to qualified patients and whether services meet quality standards set by the FHF, neither the FHF nor the MOHP can protect the system from abuse.

The system to provide this information will include facility management and patient record systems developed by the various providers in accordance with data standards and requirements set by the FHF. It will also include the FHF information system, information systems of other providers, and the NHIS managed by the NICHP.

This is a critical time for the NICHP. Significant progress has been made in developing the IT infrastructure and organization. Steps are being taken to improve and expand the HIS, but steps must also be taken now towards a national health information system that will allow the MOHP monitor a

public health system with multiple providers. These providers include the MOHP, FHF, HIO, CCO, Social Insurance Organization (SIO), and others.

The NICHP is directly responsible for management and patient information systems in MOHP facilities, including new family health units, family health centers, and family health hospitals operated by the MOHP. Other providers are responsible for developing and operating information systems for their own facilities, including facilities they operate as part of the Family Health Fund system. The FHF requires an information system to support public health insurance and performance-based contracting. This system is to be constructed through the National Technology Laboratory. Providers operating facilities reimbursed by the FHF will need to meet the data reporting requirements of the fund. The MOHP requires an information system to monitor MOHP facilities in detail and to manage accreditation of providers. The MOHP also needs a system providing reliable national health indicators for policy analysis and target setting. This system is to be constructed by the NICHP. Other health care providers and the FHF will need to meet the data reporting requirements of the MOHP.

Performance indicators for all providers should be available through a MOHP Executive Information System. The EIS will draw its information from the NHIS database. This database will be a "data warehouse," containing detailed data from MOHP facilities, and less detailed data from other providers. Most data on other providers may come from the FHF information system. Some data may come directly from providers. Selected EIS indicators should determine what data the NHIS should contain, and therefore what data is needed from each provider, when it is needed, and in what form. These requirements are needed to complete the design of the NHIS.

Data reporting standards are needed to permit information from various providers to be integrated in the NHIS and presented through the EIS. Data reporting standards include data coding, data formats, file formats, and data transmission. In addition, policies are needed concerning data privacy and access. It should be clear all stakeholders, including the MOHP, FHF, HIO, and others have an interest in data reporting standards. Each provider should be free to select information technologies they feel meet their needs, but should also be accountable for meeting data reporting standards of the FHF and the MOHP. A representative coordinating body is needed so providers have input into these standards and policies. The FHF is expected to specify, document, and provide data reporting standards for providers contracted to the Fund. The NICHP will be called upon to specify, document, and provide data reporting standards with respect to the NHIS.

4.1.2 Facility Information Systems

This document does not discuss developing management systems for governorate health directorates or facilities. The DDM project produced three such systems: general accounting, drug inventory control, and personnel/payroll. These systems were tested centrally in Alexandria with varying degrees of success. All three systems need to be upgraded to be consistent with HIS 2000; whether or how to continue development of these systems has not yet been determined

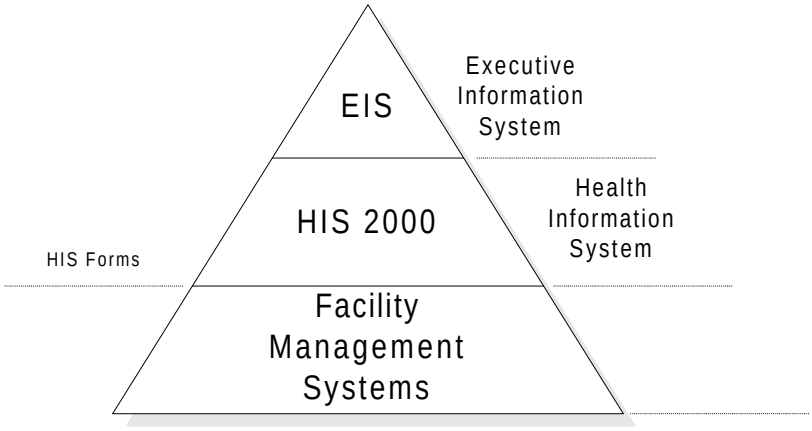
Facility management systems, such as hospital management systems, are also not addressed by this plan. These systems maintain detailed information on resources, services, and patients within each facility. Like the automated management systems introduced by DDM, facility management systems would eliminate several HIS forms while providing vital information for the facility. The patient-based system already developed by the NICHP is one example.

If introduced successfully in governorate health directorates, these systems would eliminate some HIS forms, reduce manual record keeping, and provide valuable information to the governorate health directorates and major facilities. Some important steps have been taken in this direction. The three management system modules developed under DDM, as well as the patient-based system, have been designed to export information in a form compatible with the HIS. Lack of some official coding standards makes it much more difficult to integrate data produced by management information systems. Without clear official standards, health care providers will develop their own coding for manual and automated management systems.

4.2 Distinguishing between HIS and Facility Management Systems

Figure 3 is a rough conceptual diagram of the information system pyramid showing major levels. Information generally flows from the bottom to the top, providing a higher-level, more consolidated view as it moves up to higher level decision makers. The indicators needed at each level define information needed from the level below. This document discusses steps to develop an EIS and integrated HIS. The EIS will be an application for displaying important indicators to decision makers. The selected indicators will determine what information the EIS needs from the integrated HIS. HIS 2000 will integrate data collection and management systems for the current HIS and the HES.

Figure 3. The Information System Pyramid



The entire set of HIS 2000 forms (the combination of HIS and HES forms) specifies what information is needed from facility management systems. Facility management systems include patient records, drug inventory control, facility accounting, personnel/payroll, and other systems used for routine management in facilities and governorate health directorate administrative offices. Nearly all of these systems are currently manual. HIO and the CCO currently use some automated management systems. The DDM project introduced three management systems into Alexandria health directorate. Other facility management systems continue to be developed.

Facility management systems are used to manage detailed information needed at the facility level. Not all this information is needed for analysis at higher levels. For example, facility managers need detailed information on their employees, including their age, educational background, address, and so on. This kind of information is normally not needed in the central MOHP. For example, it is important for the central MOHP to know the number of doctors and how they are distributed by specialty, but not each doctor's address, age, and educational background.

The integrated set of HIS forms will specify what information should be transmitted from facility management systems to the HIS. Since most management systems in governorate health directorates are manual, the HIS will continue to collect nearly all information on paper forms for some time. This information will come from manual ledgers maintained by the facilities. In the future, automated management systems should replace manual systems in some types of facilities. These automated management systems should produce the information needed by the HIS, eliminating the need for some data collection and reducing data entry. Until this happens, data will be collected from facilities on paper forms.

It is important to understand the distinction between the health information system and facility management systems. The HIS should not be used to replace facility management systems, such as personnel/payroll. If the HIS is designed to collect this kind of detailed information, it will require tremendous resources to enter the data at the district or health directorate levels. Instead, it is important to simplify HIS data collection as much as possible, and to concentrate on collecting the data needed for analysis and decision making at higher levels. This approach is more likely to produce better results in less time.

4.3 Major Tasks

The next major version of the HIS is referred to as "HIS 2000." The strategy for developing HIS 2000 is based on the following major tasks.

- Use the DDM-developed EIS to produce an expanded, functional HIS by the end of 1999.
- Integrate the most useful HES and HIS elements using updated information technologies to produce "HIS 2000."
- Use the IDSC-developed HIS (HIS-IDSC) as the foundation for HIS 2000.
- Coordinate HIS 2000 development with the Cabinet IDSC.
- Develop strategies for integrating elements necessary to monitor health sector reform, and provide better information for management.

These tasks focus on using the best of what is currently available to produce a better, more complete, health information system. They are also designed to meet the needs of stakeholders who can be instrumental in supplying critical components. Each task is defined in more detail in the following sections.

4.3.1 Build a New Foundation

The FoxPro HIS is a well-designed system, but it is built on an obsolete software platform. It uses an older Arabic coding system, and support for this coding system is decreasing. The database architecture is not as flexible or efficient as modern designs, and it is likely to create performance problems as the quantity of data increases.

IDSC developed HIS-IDSC to move the HIS to a current computing platform and a modern database architecture. The IDSC spent a year developing HIS 99, and introduced some important concepts. HIS-IDSC is a step forward and a reasonable foundation for further development. However,

it lacks critical data integrity and validation, and it has not kept pace with HIS development in the NICHP.

The question is whether to modify the IDSC design or create another within the NICHP, based on the best features introduced by IDSC. The NICHP can learn important concepts by studying the IDSC design. However, there are major weaknesses in the current version, and it is not ready for deployment. Experience working with IDSC developers on this project suggests they will not be able to make changes quickly enough to meet the needs of the MOHP. Finally, the NICHP will not have the capability to maintain the resulting product; it will be continually dependent on the IDSC for all changes. Therefore, it is best to develop a new HIS foundation within the NICHP, using lessons learned from the FoxPro and the IDSC HIS efforts. The NICHP can develop the capacity to produce a product that meets the needs of the MOHP. Developing this capacity, and a new HIS foundation, will enable the MOHP to maintain this mission-critical information system internally.

IDSC can provide important support to the HIS at the governorate level. This support includes hardware and hardware maintenance, training, and telecommunication through the governorate information centers. Continued cooperation with IDSC at some level will help secure their continued support in the governorates. IDSC has offered to allow their lead HIS programmer and database designer to work directly with the NICHP to understand HIS-IDSC architecture.

Several steps need to be taken before making improvements in database design. These include the following:

- Data collection forms should be revised to include HIS and HES requirements and should be simplified as much as possible.
- Data validation should be developed and documented for each field and form.
- A complete set of coding standards should be developed and documented for HIS data elements.

These steps are discussed in the following sections.

4.3.2 Revise HIS Forms

Data collection forms are instrumental in defining database requirements and structure. Before designing the HIS 2000 database, HIS forms need to be reviewed and revised carefully. Most HIS forms need few or no changes. Those likely to need the most revision are the forms added under the DDM project to collect data required for budget tracking and facility costing. These are the basis for the HES.

Three major expenditure components need to be integrated into the HIS: the Budget Tracking System, the Cost Effectiveness Analysis System, and the routine information needs of the Directorate of Planning. These share many of the same data requirements. Most of those requirements are met by the HIS forms added by the DDM project. However, the governorate health directorates have never used these forms. Some require very detailed information. Some of the required coding systems have not been defined. Before building these requirements into the HIS 2000 database, HES-related forms should be reviewed and revised to make sure they meet current HES and DOP requirements. HES methodologies should be simplified as much as possible to reduce data entry.

The BTS methodology developed under the DDM project requires expenditures at the facility level. It has two major aspects: total expenditures by budget chapter (Bab), and expenditures classified by health care function. BTS classification methodology is clearly and completely documented, but will always be controversial. The most difficult task is to classify salaries in facilities where medical staff divide their time among various functions. The DDM project demonstrated the level of effort required for collecting this data. The project concluded it was not practical to apply this detailed methodology nationally without automated facility management systems. A simplified BTS formula has been developed to estimate the key indicator (total primary health care expenditures) for the health sector reform program. This national indicator does not provide detailed information about health care expenditures in districts or facilities, but does determine primary health care expenditures as a percentage at the national and governorate levels. This simplified BTS approach is more practical and can be integrated into the HIS easily.

The CEAS component of the HES has most of the same data requirements as the BTS but is applied to hospitals at the departmental level. DDM conducted extremely detailed costing studies of several hospitals. The HIS could collect this data routinely if data requirements were simplified.

In addition, the DOP has designed a set of nine forms to collect data needed for assessing Bab III investment requests. The HIS should be able to produce the information specified by these forms. If these basic needs are not met, it will be very difficult to collect any expenditure data from governorate health directorates.

When integrated into the HIS, both systems will share the same data collection, entry, transmission, and technical support system. Training efforts in some areas can also be combined. However, adding HES data collection will increase data collection requirements and put more stress on governorate health directorates that collect this data. The effort needed to enter monthly and annual data needs to be estimated. Additional computer equipment, personnel, and training may be needed for data collection and entry in governorate health directorates. These needs need to be anticipated at least eight months in advance. A model to produce these estimates exists and is being introduced into the NICHP. These estimates should be used to determine whether there are enough personnel to enter the data, and whether data entry needs to be decentralized to the districts.

Annex D contains an example schedule showing the steps taken to collect and process HIS data. It begins with the distribution of forms to the facilities and ends with presentation of EIS results in the MOHP. The times shown are rough estimates and should be adjusted based on experience. Data entry time estimates from the model described above can be entered into this model schedule. This schedule can be used to gain a clear understanding of the process, and identify areas for improvements that shorten the cycle and produce quicker results.

4.3.3 Specify Data Validation

Data validation specifications need to be written for each form and field, including default values, required entries, range limits, valid sets, whether blank or null entries are permitted and how they should be interpreted, and so on. These specifications should also include validation ensuring that entries on the same form are logically consistent. Annex C contains an example framework. These specifications need to be completed carefully and programmed into the database, not just the data entry software. Validation in the data entry software should be in addition to complete validation specified in the database and should follow the same specifications. Coding validation and data integrity rules in the database allow the same rules to be applied to all applications using the database, and will move with the database when it is upsized to Microsoft SQL Server.

Coding data integrity and validation into the database structure is the first step in improving data quality control. Data completeness and consistency also need to be examined at a higher level. Standard protocols, queries, and reports are needed to screen incoming data at the governorate and central levels. These can determine how much requested data is being collected and entered, whether abnormally high or low values are being reported, and whether values entered on related forms are logically consistent. It should be possible to track possible problems to individual data entry operators and facilities. Selected indicators can be tracked over time to determine when and where adjustments are necessary, and whether those adjustments are successful. Adjustments could include training facility or information center personnel, altering forms, or changing data entry software. The HIS currently has no formal data quality control monitoring system. This should be added during the development of HIS 2000. Selected governorate health directorate and NICHP personnel should be trained to use this system.

4.3.4 Develop and Set Coding Standards

Data coding standards must be formalized, documented, and institutionalized. The NICHP should maintain a master set of code tables in a database, and should publish and be able to provide complete documentation on these standards to anyone dealing with the NHIS. These codes should allow data from different parts of the public health care system to be integrated and cross-referenced. In some cases the NICHP may be the authority responsible for establishing codes. In other cases, other authorities within the MOHP, the government of Egypt, or international organizations may be the controlling authorities. When external authorities maintain certain codes, the NICHP should have a clear protocol for maintaining its copy of these codes. Annex B contains a current assessment of codes used by the HIS and related systems showing inconsistencies, duplication, and gaps. This table should include a single standard for each item specifying the following:

- The name and location of the master code table;
- Who is the code authority;
- who Is responsible for updating the NICHP copy; and
- When and when and how decentralized components of the NHIS will receive code updates.

The new coding standards need to be incorporated into HIS 2000 database design.

4.3.5 Specify Relational Integrity in the Database

IDSC normalized the HIS database structure and implemented it in Microsoft Access 97. Normalization could be improved in a few areas. No referential integrity rules are specified in this database, a significant weakness can result in invalid entries. Referential integrity needs to be fully specified in the database to make sure relationships between tables are maintained regardless of the software used to enter or retrieve data.

The IDSC design should be revised to meet revised requirements of the combined HIS and HES data collection forms. All table relationships should be fully specified in the database design. The design should include a complete set of official coding standards, and all tables should include field and record validation.

4.3.6 Develop a Data Conversion Utility

Data continues to be collected on forms and entered into the FoxPro HIS. All data previously entered into this version of the HIS will need to be transferred to HIS 2000. Database structures and coding systems will be different, requiring careful, accurate, and complete conversion. Data for all 27 governorate health directorates will need to be converted. The only way to do this efficiently and accurately is to develop and test an automated data conversion utility. Programming and testing this utility will be a demanding task, but there is no reasonable alternative. Development can begin as soon as the HIS 2000 database design and coding systems are complete. The data conversion utility will be needed to provide data for testing, and will certainly be needed to deploy HIS 2000.

4.3.7 Develop Automated Data Management Procedures

In governorate health directorates, data is often entered on two or more stand-alone PCs. Data is sent to the NICHP on separate diskettes. It should be possible to take data entered on separate computers and easily combine it into a single database at the governorate level. This would give governorate health directorates access to their own results without waiting for data to be processed by the NICHP. It would also simplify processing in the NICHP. An automated procedure is needed to make this possible. Automated procedures are also needed by governorate health directorates to make it easy to backup HIS data to removable media, and to archive HIS data to conserve on-line storage space. Easy-to-use automated procedures for data management will help avoid duplication and loss of data.

4.3.8 Modify Data Entry and Reporting Software

HIS-IDSC data entry and reporting is implemented in Microsoft Visual Basic and Seagate Crystal Reports for Visual Basic. This software will need to be modified to match changes in the database and to incorporate new procedures for data quality control, data consolidation, backup, and archiving. Crystal Reports is a good solution for routine management reports but an additional skill needed in the NICHP. Ad hoc reporting can be done more easily using Microsoft Access. It may also be possible to use Access 2000 for routine management reporting instead of Crystal reports. This decision should be made after examine the HIS-IDSC reports, new reporting requirements, and new features in Access 2000.

4.3.9 Coordinate with the Cabinet IDSC

The Cabinet IDSC is responsible for collecting basic data from all government sectors for use by the Cabinet. Their interest is in access to HIS data for reporting to the Cabinet. They have invested considerable time developing HIS-IDSC. They are also able to provide badly needed technical support in governorate health directorates, and provide connections to governorate information centers and other important resources. Development of HIS-IDSC has been slow. Skilled programmers are in short supply at the IDSC, and the distance between the NICHP and IDSC has made it difficult for the two parties to work together closely. A cooperative development agreement is needed. This should allow the lead IDSC programmer and database designer to work closely with the NICHP on-site, and should transfer HIS development to the NICHP efficiently.

4.3.10 Produce a Working EIS by the End of 1999

The EIS will serve several purposes. It will help NICHP personnel develop a better understanding of how information from the HIS can be presented to higher-level decision makers. It will help decision makers understand what information is and is not available from the HIS, and how this kind of tool might be used. It should also increase interest in what the HIS can provide, and will highlight its deficiencies.

The EIS will be developed and introduced using a phased approach. In Phase 1 (1999) it will be introduced to the minister of health, undersecretaries, and other selected decision makers designated by the minister. In Phase 2 (2000) it will be introduced to other department heads and high-level decision makers in governorate health directorates.

The needs of high-level decision makers in governorate health directorates are different from those in the MOHP. Health directorates have more use for detailed information about individual facilities, and for comparisons of facilities and districts. The MOHP has more use for comparisons of governorates, and for comparing facilities of the same type. Both types of users need to view changes in indicators over time in comparison with norms or benchmarks. Both types of users need to be alerted to exceptional result values.

The environment in most governorate health directorates calls for an EIS application than can run on a single, stand-alone PC. Results could be updated monthly by transferring the necessary files from the governorate health information center on diskette. Eventually, some governorate health directorates may provide access to monthly results through a local area network.

The current environment in the MOHP also calls for a stand-alone EIS. However, there are plans to extend the MOHP network soon to other buildings and offices. This will provide more direct access to HIS results. Eventually, an Intranet Web-based EIS may provide the MOHP with the most flexible EIS platform.

A functioning EIS must be produced before the end of 1999. Based on current estimates, HIS 2000 will not be ready for widespread deployment until the second half of 2000. HIS-IDSC, the current FoxPro system, will be used to produce results for 1999 and 2000, until data collection and entry can be shifted to HIS 2000. At that time, health directorate personnel will need to be trained to use the new system, and historical data will need to be converted.

The EIS developed by DDM is constructed using Microsoft Excel. The Excel-based EIS is very flexible. It can run on a stand-alone PC, with data updates delivered on diskettes. It can also run over a local area network, with results updated over the network directly from the HIS database. The existing EIS displays BTS results using a combination of BTS and HIS data tables. This foundation can be modified to produce indicator displays based on HIS results from the existing FoxPro HIS, which remains operational. EIS development will be transferred to the NICHP through short-term technical assistance. It should not be difficult to produce at least two versions: one for use in governorate health directorates, and another for use in the MOHP. Many NICHP staff members have the basic skills necessary to do this work. This activity will begin immediately in parallel with HIS 2000 development efforts described above. The EIS will provide access to current FoxPro HIS results now, but will be easy to modify to use HIS 2000 results when they are available. The structure of the EIS will confine most modifications to the SQL database queries.

4.4 Development Teams

Separate but overlapping teams will be formed to carry out these tasks. Major HIS 2000 development tasks will be assigned to separate teams as follows:

1. Forms review team (9)
2. Data quality control team (5)
3. Coding standards team (5)
4. HIS 2000 database design team (6)
5. HIS 2000 software development team (3)
6. Data consolidation team (3)
7. Data management team (3)
8. EIS development team (5)
9. HES development team (4)

The numbers in parentheses above are the recommended numbers of members in each team.

These teams will include regular NICHP personnel, new hires from the Information Technology Institute, and project staff who have been transferred into the NICHP from the Healthy Mother Healthy Child project, Cost Recovery for Health Project, and Data for Decision Making Project.

An agreement has been reached with the Cabinet IDSC that will allow their lead HIS-IDSC programmer work in the NICHP with the NICHP development team. IDSC also offered the lead database designer to help improve and update the database design. PHR will provide short-term technical assistance in relational database design and EIS development.

Annex E contains a more detailed description of each HIS 2000 development task and team, including related training courses.

4.5 Schedule

Annex F contains a preliminary HIS 2000 project schedule. This schedule shows major steps in development and how they are related. Time estimates in this plan are preliminary; they need to be discussed by each team and adjusted according to sense of the team and project deadlines. This schedule should be posted in the NICHP and reviewed weekly. Actual progress should be displayed against the project baseline.

Annex A. Inventory of Existing Software Applications

System	Target Organization	Application	Data/Indicators	Software Platform	Hardware Platform	Arabic Code Page	Comments
MOHP/URC							
1	Five Phase A MOHP hospitals	Biomedical Equipment Assets, Preventive and Corrective Maintenance	Available equipment, condition, and Maintenance schedule	Database: Arabic MS Access 2.0	Stand Alone IBM-compatible PC	Arabic MS DOS/Windows	Installed and operated in MOHP hospitals
2	Five Phase A MOHP hospitals	Patient Master Index	Patients registered	Database: Arabic MS Access 2.0	Stand Alone IBM-compatible PC	Arabic MS DOS/Windows	Installed and operating in five hospitals; plans to add diagnosis and service rendered
3	Five Phase A MOHP hospitals	Admission/ Discharge / Transfer (Inpatient Module)	Entry and exit of patients	Database: Arabic MS Access 2.0	Stand Alone IBM-compatible PC	Arabic MS DOS/Windows	Installed and operating in five hospitals; capacity problems in Shark El Medina Hospital
4	Five Phase A MOHP hospitals	Personnel/Payroll	Personnel characteristics, assignments, salaries	Database: Arabic MS Access 2.0	Stand Alone IBM-compatible PC	Arabic MS DOS/Windows	Installed and operating in five hospitals
5	Five Phase A MOHP hospitals	Material Management (drugs, medical supplies, non-medical supplies, spare parts)	Supply, consumption, inventory of drugs and other materials	Database: Arabic MS Access 2.0	Stand Alone IBM-compatible PC	Arabic MS DOS/Windows	Installed and operating in five hospitals
6	Five Phase A MOHP hospitals	Training Administration	Persons trained, Courses Delivered	Database: Arabic MS Access 2.0	Stand Alone IBM-compatible PC	Arabic MS DOS/Windows	Installed and operating in five hospitals

System	Target Organization	Application	Data/Indicators	Software Platform	Hardware Platform	Arabic Code Page	Comments
MOHP/Child Survival, Mother Care							
7	Governorate, District, Facility	Health Information System (HIS)	Primary and Service delivery, personnel, drug, consumption, etc.	Database: MS FoxPro	Stand Alone IBM - compatible PC	Arabic MS-DOS	Deployed in 21 governorates HICS; perhaps six operating; three mature installations; plans to decentralize to district
Data for Decision Making (DDM)							
8	Governorate, District, Facility	Budget Tracking System	Expenditure by budget category and broad health care function categories	Spreadsheet: Borland Quattro Pro for Windows 5.0 or later	Stand Alone IBM-compatible PC	N/A	Documented spreadsheet system; requires aggregate inputs; no built-in provision for historical trend analysis or intergovernorate comparison
9	Facility	Facility Costing System	Detailed costing of facilities by department	Spreadsheet: Borland Quattro Pro for Windows 5.0 or later	Stand Alone IBM-compatible PC	Arabic MS DOS/Windows	System of interconnected spreadsheets; undocumented; primarily English some Arabic
10	Governorate, District, Facility	Drug Inventory Control	Drug supply, consumption, inventory, price	Database: Dbase IV	Stand Alone IBM-compatible PC	Nafitha	Modification of software in use by CCO for four years; Arabic; being coordinated with BTH/HIS development; to be deployed by DDM to three or more governorates

System	Target Organization	Application	Data/Indicators	Software Platform	Hardware Platform	Arabic Code Page	Comments
11	Governorate	Personnel/Payroll	Personnel. Specialties, work location, salaries, bonuses, adjustments	Database: V Basic / Access	Stand Alone IBM-Compatible PC	Arabic MS DOS/Windows	Modification of software in use by CCO; Arabic; being coordinated with BTS/HIS
12	Governorate	General Accounting		Database: Dbase IV	Stand Alone IBM-compatible PC	Nafitha	Modification of software in use by CCO; Arabic; being coordinated with BTS/HIS
HIO/MAXIMUS							
13	HIO headquarters branch offices, polyclinics	Beneficiary Registration	Beneficiary eligibility	Database: Oracle7	Multi-user host, dumb terminals	ASMO 708	Software complete. Fully deployed in clinics of Cairo Branch. Partially deployed in clinics in NWD Branch
14	HIO headquarters branch offices, polyclinics	Patient Records	Reasons for use of HIO services, treatment received, length of outcome, dispensation of optical and prosthetic devices	Database: Oracle7	Multi-user host, dumb terminals	ASMO 708	Software complete. Inpatient module fully deployed in Medinet Nasr Hospital, Cairo
15	HIO hospitals	Admission/Discharge/Transfer	Reason for beneficiary admission, discharge or transfer to/from facility	Database: Oracle7	Multi-user host, dumb terminals	ASMO 708	Software complete. Fully deployed in Medinet Nasr Hospital, Cairo

System	Target Organization	Application	Data/Indicators	Software Platform	Hardware Platform	Arabic Code Page	Comments
16	HIO headquarters branch offices, polyclinics and hospitals	Periodic Medical Examination	Triggers for scheduled examinations based on beneficiary condition or occupation	Database: Oracle7	Multi-user host, dumb terminals	ASMO 708	Beta test just finished, Cairo Branch
17	HIO headquarters branch offices, polyclinics and hospitals	Cost Accounting	Tracks costs for all aspects of HIO business	Database: Oracle7	Multi-user host, dumb terminals	ASMO 708	Beta to be completed mid-February for hospitals (Medinet Nasr)
18	HIO headquarters branch offices, polyclinics , hospitals and stores	Drug Control	Drug supply, consumption, inventory, price	Database: Oracle7	Multi-user host, dumb terminals	ASMO 708	Data to be completed in mid-February for hospitals (Medinet Nasr)
19	HIO branch offices	Contracted pharmacy	HIO prescriptions filled by contracted pharmacies	Database: Oracle7	Multi-user host, dumb terminals	ASMO 708	Completed and used in Cairo Branch
20	HIO branch offices	Contracted providers	HIO services provided by contracted physicians, clinics, and hospitals	Database: Oracle7	Multi-user host, dumb terminals	ASMO 708	Completed and used in Cairo branch
21	HIO hospitals, polyclinics	Medical Quality Assurance	Outcome to medical care	Database: Oracle7 / Oracle Developer 2000	Network Server, PC Workstations	ASMO 708-Arabic MS DOS/Windows	Completed for polyclinics. Data to be completed in hospitals

System	Target Organization	Application	Data/Indicators	Software Platform	Hardware Platform	Arabic Code Page	Comments
22	HIO headquarters branch offices	Management Reporting	Cost and quality of care	Database: Oracle7 / Oracle Developer 2000	Network Server, PC Workstations	ASMO 708-Arabic MS DOS/Windows	Data to be completed in mid-February
CCO							
23	CCO hospitals	Drug Inventory Control	Consumption, Inventory, and supply of pharmaceuticals	Database: Dbase IV	Stand Alone IBM-compatible PC	Nafitha	In use for four years
Family Planning Project							
24	MOHP FP Clinics	FP materials consumption and supply	Consumption and supply of family planning materials	Database: Unknown	Stand Alone IBM-compatible PC	N/A	In use for several years

Annex B. Inventory of Current Coding Systems

System Number	Element	Example	Code Format	Number of Items	File/Table	System	Comments	Source	Authority
1	Country	France, Germany, Hungary,…	XX	31 13	CS070000.DBF (Arabic) Common_DB.[Country] (Arabic)	FoxPro HIS IHIS-IDSC	Used to record source of equipment, vehicles, furniture, etc.	GOE	NICHP/HDSS
2	Governorate	Cairo, Alexandria, Port Said,…	XX	28 27 27 28 28	CS001000.DBF (Arabic) GOV.DBF (English) GOVS.DBF (English) BT001000.DBF (English) Common_DB.[Governorate] (Arabic)	FoxPro HIS FoxPro HIS FoxPro HIS BTS IHIS-IDSC		GOE	CAPMAS
4	District	Heliopolis, Nasr City, Zaitoun, Wassat,...	XX	238 228 100 238	CS002000.DBF (Arabic) DISTRICT.DBF (English) BT002000.DBF (English) Common_DB.[DISTRCT] (Arabic)	FoxPro HIS FoxPro HIS BTS HIS-IDSC	BT002000.DBF contains only 100 districts. DISTRICT.DBF contains only 228 districts. Common_DB.[DISTRCT] contains at least three special entries.	GOE	CAPMAS
5	Profession	Herbal Medical Technician, Pharmacist Assistant, Bone Setter, Environmental Health Technician, Plastic Surgery Technician, Ambulance Worker, Specialist Assistant in New Health, General Nurse, Chief Nurse,...	XXXXXX	169 159 169	CS079000.DBF (Arabic) BT079000.DBF (English) Common_DB.[PROF_NAMES] (Arabic)	FoxPro HIS BTS HIS-IDSC	BT079000.DBF contains only 159 entries; it must be updated. BT079000.DBF contains an additional column (FK) classifying each specialty as medical or non-medical (BT079001).	GOE	CAPMAS
6	Professional specializa-tion		XXX	34 34	CS077000.DBF (Arabic) Common_DB.[PROF_SP] (Arabic)	FoxPro HIS HIS-IDSC		GOE	CAPMAS
7	Professional function, general	Medical, Nonmedical	X	2	BT079001.DBF (Arabic & English)	BTS		GOE	NICHP
8	Facility division	Surgery, General Medicine, Pediatrics Department,…	XXX	110	CS080000.DBF (Arabic)	FoxPro HIS		GOE	NICHP/HDSS
9	Budget Chapter	Bab I, Bab II, Bab III, Bab IV	X	4	BT200000.DBF (Arabic & English)	BTS		GOE	NICHP
10	Budget item codes				CS084000.DBF	FoxPro HIS	No coding system has been established yet.	GOE	NICHP/HDSS
11	Function	Curative, Preventive, Primary or MCH, Family Planning, Administration, Multifunction	X	6	BT200001.DBF (Arabic & English)	BTS		GOE	NICHP
12	Facility	MOHP facility	XXXXXX	6665 6514	CS003000.DBF (Arabic) Common_DB.[FAC] (Arabic)	FoxPro HIS HIS-IDSC		GOE	NICHP/HDSS

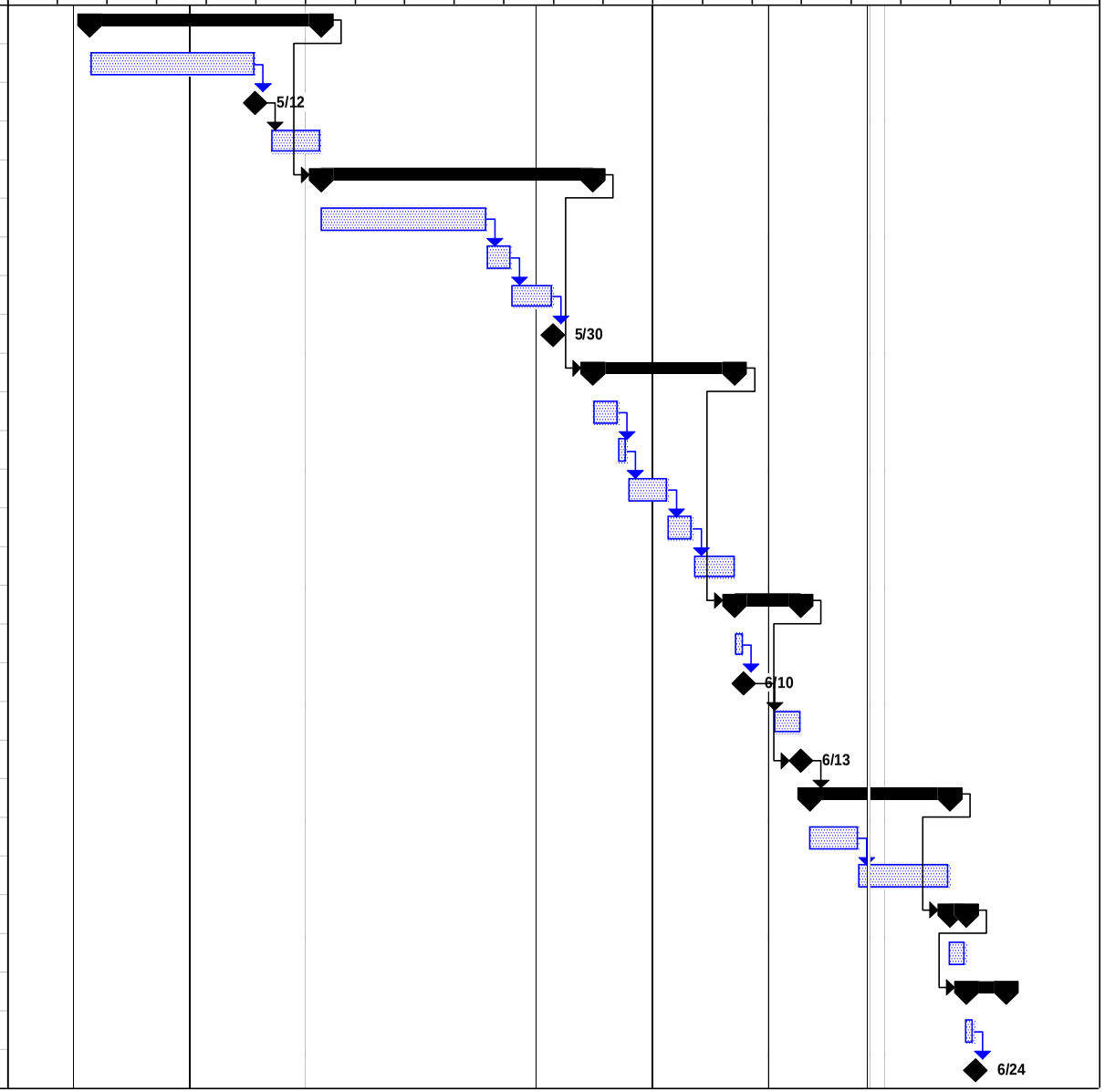
System Number	Element	Example	Code Format	Number of Items	File/Table	System	Comments	Source	Authority
13	Facility Type	Type of facility (General Hospital, Chest Hospital, Rural Health Unit, etc.)	XXX	109 109 109	CS078000.DBF (Arabic) BT078000.DBF (English) Common_DB.[FACTYP] (Arabic)	FoxPro HIS BTS HIS-IDSC		GOE	NICHP/HDSS
14	Facility Group	Hospital, Nonhospital, Multifunction	X	3	BT078001.DBF (Arabic & English)	BTS	Used by BTS/EIS prototype developed under DDM.	GOE	NICHP
15	Hospital Type	Type of hospital (General, District, Specialized, Rural, etc.)	X	8	BT078002.DBF (Arabic & English)	BTS	Used by BTS/EIS prototype developed under DDM.	GOE	NICHP
16	Facility Function	Master classification of facilities by function (Curative, Preventive, MCH, etc.), type (General Hospital, Rural Health Unit, etc.) and hospital type (General Hospital, Specialized Hospital, etc.)	N/A	109	BT078003.DBF (N/A)	BTS	Used by BTS/EIS prototype developed under DDM.	GOE	NICHP
17	Drug	Pharmaceuticals	XX XXXXXXX XXXX XX.XX.XX XXXXX.X XXXXX	21 5312 3800	CS072000.DBF (Arabic) Drugs Data.[CODE] (English) Three related tables	FoxPro HIS MOHP Standard DPS DIC (CCO) HIO	The current HIS table contains 21 types of family planning materials using a unique coding system.	GOE International	NICHP/HDSS
18	Vaccine	Vaccines	XX	13 13	CS073000.DBF (Arabic) Common_DB.[VAX] (Arabic)	FoxPro HIS HIS-IDSC	The current HIS table contains 13 selected entries using a unique coding system.	GOE	NICHP/HDSS
19	Medical supplies	Swabs, gauze, X-ray film, sutures,…			CS074000.DBF	FoxPro HIS	No coding system has been established yet.	GOE	NICHP/HDSS
20	Medical equipment	Renal dialysis, X-ray							
21	Furniture				CS075000.DBF	FoxPro HIS	No coding system has been established yet.	GOE	NICHP/HDSS
22	Meals	Types of hospital-provided meals	X	7	CS076000.DBF (Arabic)	FoxPro HIS		GOE	NICHP/HDSS
23	Disease	Type of disease and medical interventions.	XXX.X	2083	CS081000.DBF (Arabic)	FoxPro HIS	International	WHO	
24	Cancer	Type of cancer					International	WHO/Lyons	
25	Surgical operations	Type of medical operation.	XXXXXX	870 871	CS082000.DBF (Arabic) Common_DB.[SURG] (Arabic)	FoxPro HIS HIS-IDSC	The last entry in Common_DB.[SURG] is a mistake or test entry.	GOE?	NICHP/HDSS

Annex C. Example Validation Specifications

FOXHIS FILENAME	FOXHIS FIELDNAME	HIS 2000 TABLENAME	HIS 2000 FIELDNAME	ENG_PROMPT	TYPE	WIDTH	DEC	LOOKUP	DEFAULT VALUE
CS001000	GOVERN_CD	[Governorate]	GOVERN_ID	Governorate Code	N		0		Set by configuration
CS001000	GOVERN_NM	[Governorate]	GOVERN_NM	Governorate	T	30	0		
		[Governorate]	GOV_LOC	Location	N		0	[location]	
CS002000	GOVERN_CD	[DISTRCT]	dis_gov	Governorate Code	N		0	[Governorate]	
CS002000	DISTRCT_CD	TRCT]	DISTRCT_ID	District Code	N		0		Set by configuration
CS002000	DISTRCT_NM	[DISTRCT]	DISTRCT_NM	District Name	T	30			
		[DISTRCT]	DISTRCT_LOC	Location	N		0	[location]	
CS003000	GOVERN_CD	[FAC]	GOVERN_ID	Governorate Code	N	2	0	[Governorate]	
CS003000	DISTRCT_CD	[FAC]	DISTRCT_ID	District Code	N	3	0	[DISTRCT]	
CS003000	FAC_CD	[FAC]	FAC_ID	Facility Code	N		0		
CS003000	FAC_NM	[FAC]	FAC_NM	Facility Name	T	40			
CS003000	S_YEAR	[FAC]	S_YEAR	Opening Year	D	4			
CS003000	E_YEAR	[FAC]	E_YEAR	Closing Year	D	4			
		[FAC]	FAC_LOC	Location	N		0	[location]	
		[FAC]	FAC_TYP	Facility Type	N	3	0	[FAC_TYP]	
CS004000	GOVERN_CD								
CS004000	DISTRCT_CD								
CS004000	FAC_CD	[Fac_basicinfo]	FAC_ID	Facility	N	6		[FAC]	
CS004000	YEAR			Year	N	4			
CS004000	TEL	[Fac_basicinfo]	TEL	Telephone	T	10			
CS004000	ADDR_NO	[Fac_basicinfo]	ADDR_NO	Block No.	T	4			
CS004000	ADDR_ST	[Fac_basicinfo]	ADDR_ST	Street	T	25			
CS004000	ADDR_AREA	[Fac_basicinfo]	ADDR_AREA	Area	T	15			
CS004000	TOT_BEDS	[Fac_basicinfo]	TOT_BEDS	Total Beds	N	5			
CS004000	F_CD	[Fac_basicinfo]	F_ID	Health Bureau	N	6			
CS004000	SCOPE_KM2	_basicinfo]	SCOPE_KM2	Area	N	10			
CS004000	SCOPE_POP	[Fac_basicinfo]	SCOPE_POP	Popul.	N	10			

Annex D. HIS Data Collection and Processing Schedule

ID	Task Name	Duration
1	**Distribute and collect forms**	**16 days**
2	Each facility completes monthly forms	12 days
3	Facilities return completed forms to the di	1 day
4	District health offices deliver completed fc	3 days
5	**Enter, QC, consolidate data**	**19 days**
6	The HDIC enters the data from the forms,	12 days
7	The HDIC runs compliance and exceptior	2 days
8	Compliance and exception reports are del	2 days
9	The HDIC consolidates data from differen	3 days
10	**Generate and distribute reports**	**10 days**
11	The HDIC runs standard management rep	2 days
12	The HDIC delivers management reports t	1 day
13	The HDIC runs standard comparison and	2 days
14	Compliance, exception, comparison, and	2 days
15	Districts deliver reports to facilities.	3 days
16	**Governorate EIS reporting**	**4 days**
17	HDIC produces standard EIS indicators	1 day
18	HDIC makes EIS results available	1 day
19	The HDIC delivers consolidated monthly	2 days
20	The HDIC delivers monthly results to NICHP.	1 day
21	**Central QC and consolidation**	**10 days**
22	NICHP runs compliance and exception re	4 days
23	NICHP consolidates data from different H	6 days
24	**Central management reporting**	**1 day**
25	NICHP runs standard management repor	1 day
26	**Central EIS reporting**	**2 days**
27	NICHP produces standard EIS indicators	1 day
28	NICHP makes EIS results available throu	1 day



Annex E. HIS 2000 Development: Major Tasks and Teams

Objectives

Long-term Objectives

- A reliable, efficient, and sustainable system to produce information needed to monitor and manage Ministry of Health and Population (MOHP) health care facilities, and evaluate policies.
- A reliable, efficient, and sustainable system to monitor health services outside the immediate control of the MOHP.

Both objectives listed above should be kept in mind while developing Health Information System (HIS) 2000.

Short-term Objectives

- Integrate HIS and Health Economics System (HES) (Budget Tracking System [BTS], Cost Effectiveness Analysis System [CEAS], etc.) data requirements into a single data collection, processing, and reporting system.
- Improve data quality control and management.
- Establish clear data coding standards for the health care sector.
- Strengthen database structures through sound engineering so the system can be expanded without breaking.
- Move databases and software to a modern platform with a better future and a common Arabic code page.
- Produce an Executive Information System (EIS) that displays useful indicators routinely from reliable, updated data.

Objectives 1 and 6 above are important benchmarks for the MOHP and must be achieved by the end of 1999.

Teams

These working teams are formed to accomplish specific tasks necessary to produce a good foundation for a national health information system. Working teams are not formal departments, but bring members of the National Information Center for Health and Population (NICHP) and Directorate of Planning (DOP) together to accomplish specific HIS 2000 development objectives.

Working teams should be formed integrating NICHP and DOP staff from a variety of backgrounds (MOHP, University Research Co., LLC, Healthy Mother Healthy Child [HMHC], Data for Decision Making [DDM], Information Technology Institute [ITI]) and levels of skill and experience. Teams should not be mutually exclusive; members of one team may also be members of one or more related teams. It is critical to include MOHP personnel on these teams, even if they initially act primarily as observers. MOHP personnel must become knowledgeable about HIS 2000 so they can support the NICHP.

Team Coordinator

Each team should have a coordinator. The team coordinator is responsible for organizing and mediating team meetings to meet team objectives on time. The team coordinator may also assign specific tasks and deadlines to team members. The team coordinator is responsible for dividing tasks among team members to improve the efficiency of the work.

Overall coordination of all working teams will be the responsibility of the NICHP senior system analyst, under the direction of the general director, and advised by the PHR HIS advisor.

Team Working Sessions

Teams should meet for working sessions at regular times. Some teams may meet daily for three to four hour working sessions. The numbers in parentheses below are the suggested numbers of persons on each team.

1. Forms review team (9)
2. Data quality control team (5)
3. Coding standards team (5)
4. HIS 2000 database design team (6)
5. HIS 2000 software development team (3)
6. Data consolidation team (3)
7. Data management team (3)
8. EIS development team (5)
9. HES development team (4)

Forms Review

Problem

HIS 2000 development will begin using EIS requirements as a starting point. New forms will be developed based on these requirements. These forms should be designed to minimize data collection and entry effort. The possibility of using scannable forms should be investigated carefully.

It is important to compare new forms with existing HIS forms to estimate the amount of retraining needed by health directorate personnel. Data entry requirements for new forms will also need to be estimated.

The data requirements of the Health Economic System (Budget Tracking, Cost Effectiveness Analysis, National Health Accounts [NHA], and National Hospital Survey [NHS]) should be integrated into the data collection system as much as possible. Planning departments in governorate health directorates may collect and enter data for the HES. Eventually this data should be transferred to the Health Information Center (HIC) to be integrated with the HIS, and transferred to the NICHP along with other HIS data.

Human resources in governorate HICs and district offices are an important consideration. Data collection and data entry must be simplified and reduced as much as possible, while still meeting the most important information needs. It may be possible to simplify some complex methodologies, such as BTS and CEAS, while still producing the necessary results. It is important to make a strong effort to simplify these methodologies as much as possible while still producing the necessary results. This should simplify data collection and processing.

Objective

Identify the most important information requirements. Simplify HES methodologies as much as possible and adjust to meet the requirements of monitoring the health sector reform. Simplify and reduce data collection if possible. Combine forms if possible. Complete a set of HIS 2000 forms combining HIS and HES data collection needs.

Tasks

1. Review existing forms. Note all improvements that should be made in forms for the next version of the HIS. Forms required to collect data needed for BTS should be reviewed considering the latest BTS data requirements. BTS data requirements must be integrated into the HIS in this phase.

2. Investigate the possibility of using scannable forms to reduce data entry effort.

3. Develop MS Access reports to print data entry forms required at any level. Pre-print as much information as possible on the forms from the HIS database.

4. Estimate the average amount of time it will take to enter the data from each type of form.

5. Estimate total monthly and annual data entry time for each governorate and district.

Team Requirements

- Familiarity with HIS
- Familiarity with BTS

Related Training Courses

None

Deliverables

1. A report detailing improvements in HIS forms, conclusions from an investigation of form scanning technologies, and estimated data entry requirements (computer hardware, consumable supplies, operating costs, and human resources) for each governorate health directorate

2. MS Access reports to print HIS 2000 forms

3. A complete set of technical documentation, including example forms

Data Quality Control

Problem

The HMHC HIS team experienced several problems with the quality of HIS data submitted by governorate HICs. Some of these problems could be prevented through database design (referential integrity) and validation, and some could be prevented through user interface validation. Reports listing unusual data values ("exception reports") and reports of data completeness ("compliance reports") could be used by governorate HICs and the NICHP to monitor and improve reporting completeness and data quality. Governorate HIC staff will need training in new validation features and use of exception and compliance reports. The same database integrity, data validation, compliance reports, and exception reports should be used by the NICHP to monitor the completeness and quality of data submitted by governorate HICs. Referential integrity, field and record-level data validation, exception reports, and compliance reports need to be built into HIS 2000.

Objective

Improve HIS data quality in the HICs.

Tasks

1. Review and document complete data validation requirements field by field and form by form. Documentation should be printed from the database software based on validation specifications entered into the database.

2. Develop exception standards and reports to screen for unusual values (cross-section).

3. Develop exception reports to screen for unusual changes in values (longitudinal).

4. Determine whether it is worth improving validation in the existing FoxPro HIS while HIS 2000 is being developed.

5. Develop and test compliance and exception reports in Access 2000 using data imported from FoxPro HIS files. Keep in mind that it should be possible to use the same reports in the NICHP to monitor data submitted by the governorate HICs.

6. Develop training materials for use in governorate HICs. Training materials should document field and form validation rules, exception reports, and compliance reports. Training materials should explain how to use compliance and exception reports.

Team Requirements

- Understanding of data quality problems with the existing HIS
- Understanding of HIS data forms and data processing
- Understanding of HIS coding systems
- Familiarity with field and record-level validation features in MS Access
- Familiarity with Standard Query Language (SQL)
- Experience developing Access queries and reports

Related Training Courses

- MS Access 2000 (data validation features and reporting)
- SQL

Deliverables

1. Database documentation for field and record-level validation entered into the HIS 2000 database.
2. A set of MS Access reports designed to screen HIS 2000 tables for invalid and exceptional values.
3. Documentation for the above reports listing the name and description of each report, how and when it should be used, and how results should be interpreted.

Coding Standards

Problem

HIS 2000 will be the first component of a much larger National Health Information System (NHIS) data warehouse. Data in the NHIS data warehouse will come from a variety of sources inside and outside the MOHP. If the developers of these systems use common standard coding systems, it will be easier to combine and cross reference data from different sources. For example, just using the same codes for governorates and districts will help. There should also be codes for many other standard elements, such as pharmaceutical materials, diseases, types of cancer, and so on. There is currently no clear set of well-documented and well-maintained codes in the MOHP. If there is, no one knows about it.

The Family Health Fund (FHF) should take the lead in defining, documenting, and distributing data reporting standards for FHF health care providers. The NICHP should take the lead in defining, documenting, and distributing data reporting standards for other elements of the NHIS, which includes HIS 2000. Data coding, formatting, and reporting standards will need to be discussed collaboratively by all health care providers. However, the NICHP should take the lead in proposing a well-documented set of basic coding standards.

Objective

Develop, document, and institutionalize standard coding systems required for HIS expansion and integration. Develop and implement an effective system for promoting and maintaining these codes.

Tasks

1. Review existing coding systems, including systems used by related organizations.
2. Consider what coding systems will be needed for data needed from outside the MOHP.
3. Determine whether other international or government of Egypt systems exist in areas that have no clear standard.
4. Determine which authorities maintain each system, how, and when codes are updated.
5. Select a single official standard system for each key element.
6. Implement each coding system electronically as part of HIS data architecture.
7. Document each coding system.

Team Requirements

- Familiarity with relational database design and programming
- Familiarity with existing HIS and HES systems
- Special knowledge of certain coding systems, such as ICD10 or pharmaceuticals
- Medical specialists to define and maintain some coding systems

Related Training Courses

- MS Access 2000
- Relational Database Design
- SQL

Deliverables

1. A detailed report specifying and explaining a core set of data coding and data formatting standards, listing content authorities for each coding system, and specifying when and how they will be updated, and how updates will be distributed.

HIS 2000 Database Design

Problem

The FoxPro HIS database structure is very well engineered. However, it was designed for an older database system. Modern relational databases must be designed according to certain rules to maximize their efficiency and reliability.

The Cabinet Information and Decision Support Unit (IDSC) has done a good job transferring the FoxPro HIS database design to a more normalized relational database structure. They have also made other improvements, including separating the composite facility code into a facility code that is unique nationally, and a separate facility type code. They have also included their local administration location coding system, which will be useful in many ways. There are some areas in which database normalization could be improved. Very few table relationships have been specified in the database, and no relational integrity rules have been specified. No field or record-level validation has been specified in the database. We do not have any documentation for the database structure.

Changes in HIS forms will require some adjustments in the database structure. New forms should include data requirements for the Health Economic System, which includes the Budget Tracking System, Cost Effectiveness Analysis System, National Health Accounts, and National Hospital Survey. Indicators required for the Executive Information System also require additional tables. For example, all per capita measures require tables of population estimates.

The IDSC database is a significant advance over the FoxPro database design, but is not yet completely engineered. The HIS database structure is the first component of the National Health Information System data warehouse. It is very important to make sure it is well-engineered before moving it to a more expensive database platform, and before using it to store large quantities of data.

The NICHP has reached an agreement in principle for the IDSC database engineer to provide some technical assistance in understanding the IDSC design and modifying it.

Objective

Develop and implement a well-engineered relational database design. Combine HIS, HES, and EIS data requirements.

Tasks

1. Using lessons learned from both FoxPro and IDSC database designs, develop a new relational database structure for HIS 2000.
2. Add and restructure tables as need.
3. Improving consistency in naming.
4. Improve normalization.
5. Specify referential integrity.
6. Specify field and record validation.
7. Test with SQL queries to produce required management reporting tables and indicators.
8. Document the schema, table structure, and data dictionary.

Team Requirements

- A good understanding of relational database normalization
- Familiarity with relational integrity rules and options

- Familiarity with field and record-level validation options in MS Access
- Familiarity with HIS data forms
- A good understanding of the structure of the IDSC database design

Related Training Courses

- MS Access 2000
- Relational Database Design
- SQL
- Microsoft SQL Server (Database Design, Database Management)

Deliverables

1. Printed documentation for the new database, including relational schema and data dictionary.

HIS 2000 Software Development

Problem

The IDSC has developed a new user interface for the HIS using Visual Basic 5 (VB). This database uses the new MS Access 97 databases designed by IDSC. VB was chosen because it can be used to produce a secure, stand-alone executable file (EXE), and because it provides more flexibility in programming than MS Access alone.

The VB user interface needs to be modified to match changes made in HIS forms, coding systems, and database design. Additional features will need to be added to the user interface, including compliance and exception reports, data consolidation, and data backup and archiving. The programming skills and work need to be transferred from the IDSC to the NICHP so the program can be further developed and maintained by the NICHP.

The NICHP has reached an agreement in principle for the lead IDSC programmer to work with the NICHP team on this project.

Tasks

1. Analyze and understand the structure of the existing VB program.
2. Write a detailed list of any and all problems discovered during the evaluation.
3. Determine whether any changes should be made to make the application more maintainable.
4. Evaluate the existing menu structure, forms, and reports.
5. Determine whether the existing report system should be kept or changed.

6. Determine whether any changes need to be made to application and database security.

7. Determine what changes need to be made so the application can be used safely in a multi-user network environment with a shared database.

8. Write a detailed list of changes and additions to be made.

9. Consider how additional features, such as data conversion, consolidation, backup, and archiving, will or will not be integrated into the application.

10. Assign programming and testing tasks to team members.

11. Agree on coding standards, including naming conventions, indentation, and internal documentation.

12. Write down the coding standards and make sure all team members understand them.

13. Decide how source code will be managed to avoid losing important work.

14. Decide who is responsible for controlling and safeguarding the source to the application.

15. Develop and carry out a multi-stage internal testing program (e.g., assign responsibility for testing various components to team members who document their findings, then pass responsibility for testing the same component to the next team member, so each component is tested three times internally).

16. Determine what documentation should be produced and stored in the NICHP technical library so other programmers can understand and maintain the software.

17. Test the application in several governorate HICs at the earliest possible stage of development. Observe and listen to testers carefully and write down your findings.

18. Take special care to evaluate the speed of data entry with the VB application compared to the speed of data entry with the FoxPro version. What changes should be made in the VB version to improve data entry speed?

19. During end-user testing, try to determine what kind of training will be necessary to help users move to the new user interface.

Team Requirements

- Familiarity with the existing FoxPro HIS application and how it is used in the governorates
- Good knowledge of Visual Basic programming
- Good understanding of Visual Basic database programming for multi-user environments
- Thorough understanding of relational database concepts, SQL, and the structure of the HIS 2000 database

Related Training Courses

- Introduction to Visual Basic
- Advanced Visual Basic (with emphasis on multi-user database programming)
- MS SQL Server (Database Design, Application Design)

Deliverables

1. Data entry software for the new HIS 2000 database allowing configuration for various levels (governorate, district), entry of data from new HIS forms, data quality reporting, routine management reporting, and data management tasks (import, export, backup, archive)
2. Technical manual for the software describing its architecture and functions
3. User guide for the software in Arabic designed for new users in governorate health directorates

Data Consolidation

Problem

Some governorate HICs enter HIS data on several stand-alone PCs. In some governorates, data will be entered on separate PCs in district statistical offices, in hospitals, and perhaps in various separate offices of the health directorate administration. All this data must be consolidated in the governorate HIC to build the database necessary for management and executive reporting at the governorate level. Finally, data from governorate HICs will need to be consolidated in the NICHP and added to the NIHS data warehouse.

Objective

Make it possible for HICs to consolidate data from several different data sources into a single database.

Develop an automated data consolidation protocol and training for HICs.

The protocol should be designed to validate and integrate HIS data from multiple sources. Sources may be two or more stand-alone PCs in an HIC, different districts, or hospitals. The protocol may be a combination of an automated utility and data quality control reports. The protocol should be designed for HICs that need to consolidate HIS data from more than one PC. In the future, HIS data collection may include monthly data from automated management systems in hospitals and health directorate offices, such as the central pharmaceutical supplies office, general accounting office, and personnel/payroll office. Automated procedures are needed for data consolidation at each level.

Tasks

1. Review existing FoxPro HIS procedures for importing data from multiple PCs in a governorate.

2. Develop a utility in MS Access 2000 to import HIS data from separate data entry sources. This procedure should do the following:

    - Verify the identity and structure of the data to be imported.
    - Optionally run data entry compliance and exception reports on the data to be imported.
    - Optionally add the data to the appropriate HIS 2000 data tables.
    - Report all key conflicts encountered.
    - Design the utility so it is possible to add additional data consolidation capabilities to the program structure.
    - Integrate the data consolidation utility into HIS 2000.

Team Requirements

- Excellent understanding of HIS data structures, flow, and processing
- Good knowledge of Microsoft Access database programming
- Thorough understanding of SQL
- Experience developing Access queries and reports
- Good skills in Visual Basic database programming

Related Training Courses

- Microsoft Access (Intermediate and Advanced)
- Visual Basic (Intermediate and Advanced)
- Structured Query Language
- Microsoft SQL Server (Database Management)

Deliverables

1. Easy-to-use automated facility to import and export selected data from HIS 2000, allowing data to be transferred selectively from one installation to another and consolidated without duplication or loss of data.

Data Management

Problem

Data backup and archiving procedures in the governorates need to be as simple and reliable as possible. This becomes more important as the amount of HIS data in the governorates increases. Any loss of data in the governorates may damage support for the system.

Current data needs to be backed up safely and securely. Old data needs to be archived securely to removable off-line storage. In some cases a summary of archived data will need to be kept online for comparison reports.

Objective

Improve disaster recovery and data management at governorate and central levels.

Tasks

1. Develop data backup procedures for HICs and for the NICHP.
2. Develop data production and capacity estimates for HICs and the NICHP.
3. Develop written data backup procedures for HICs and the NICHP.
4. Identify additional equipment and software needed to implement the strategy and make arrangements to procure and deploy it.
5. Train HIC staff in the backup procedures.
6. Develop and implement a system to monitor compliance.
7. Develop automated archiving procedures for HICs and the NICHP.
8. Determine the number of periods of data that need to be kept online.
9. Develop written data archiving standards for data that does not need to be kept online.
10. Evaluate and select media and locations to be used for storing archived data.
11. Develop automated data archiving utilities to simplify the process of archiving and cataloging data.
12. Identify additional equipment and software needed to implement the strategy and make arrangements to procure and deploy it.
13. Train HIC staff in the archiving procedures.
14. Develop and implement a system to monitor compliance.

Team Requirements

- Excellent understanding of HIS database architecture and data processing
- Familiarity with conditions in governorate health directorates
- Good skills in Access database programming
- Good skills in Visual Basic programming for databases
- Good understanding of data backup and archiving procedures

Related Training Courses

- Visual Basic (Intermediate and Advanced)
- MS Access (Intermediate and Advanced)
- SQL
- Microsoft SQL Server (Database Management)

Deliverables

1. An easy-to-use automated facility to selectively backup and archive HIS 2000 data in governorate health directorates.

EIS Development

Problem

The PHR project must produce a working Executive Information System by the end of 1999. The EIS must display indicators calculated from monthly HIS results. Indicators should be displayed as graphs and tables, comparing current results with results from a previous time period, or from other governorates, districts, or facilities of the same type. Users should be able to select from a menu of carefully designed indicator displays that emphasize graphics over tables. More advanced user control over displays is a lower priority.

It should be possible to use the EIS on a stand-alone PC. Data will need to be updated monthly, either in a shared network database, or by diskette transfer. This will allow the EIS to be used on stand-alone PCs in governorate health directorates, as well as in the central MOHP. In the future, we expect the EIS to be integrated into a MOHP Intranet Web site, but we need to concentrate on developing a simpler stand-alone version now to build user skills, demand, and political support.

At the end of Phase II of the DDM project, the Research Triangle Institute constructed an example EIS. This is an Excel spreadsheet application that queries FoxPro HIS and BTS database files using SQL and an ODBC driver. Record sets returned from queries are displayed in Excel Pivot Tables. Data in the pivot tables can also be displayed as graphs. The application is designed for use in Arabic or English, depending on the user's preference. The Phase II Final Report for the Budget Tracking System contains a more complete description of the application. This application is easy to modify and extend, and will serve as the basis of the new EIS.

It will take some time to design the HIS 2000 database, and even longer before data is available from health directorates in this form. The EIS must be designed to operate using data from FoxPro HIS tables now, while being easy to adapt to the HIS 2000 database later.

Objective

Modify the existing Excel-based EIS application to calculate and display key indicators from current FoxPro HIS files. Develop a procedure for updating EIS results from monthly HIS data files. Complete the user interface in Arabic and English. Prepare the application to make easy to adapt to the HIS 2000 database structure. Carefully design and execute a plan to test the EIS with users, noting changes that should be made to make the EIS more useful.

Tasks

1. Analyze the existing EIS application to understand its structure, and how it can be extended.
2. Modify the application to run correctly under Excel 97 and Excel 2000.
3. Complete the user interface in Arabic and English.
4. Select the highest priority HIS indicators, based on data available from the current HIS and on usefulness to health directorate managers and managers in the central MOHP.
5. Add necessary tables of population estimates to the HIS 2000 database structure. Select and document the best sources for these estimates, and specify how and who will keep them updated.
6. Design indicator displays, and modify the user interface to add these displays.
7. Add the capability to display time-series results.
8. Add the capability to display facility-level results.
9. Add the capability to display comparisons among facilities, districts, and governorates.
10. Design an end-user test program.
11. Execute the end-user test program, noting changes needed to improve the usefulness of the EIS.
12. Make adjustments indicated by the test program, and test again.

Team Requirements

- Good knowledge of spreadsheet software in general, and Microsoft Excel in particular
- Some familiarity with Visual Basic
- Familiarity with Microsoft Access
- Knowledge of SQL

Related Training Courses

- Microsoft Excel (Intermediate and Advanced)
- Microsoft Access (Intermediate)
- Introduction to Visual Basic
- SQL
- MS SQL Server (Database Design, Application Design)

Deliverables

1. A national-level EIS in MS Excel that can display selected indicators from the FoxPro HIS, and can be shared over the MOHP network or used on a stand-alone PC.

HES Development

Problem

The Health Economic System currently includes the Budget Tracking System, Cost Effectiveness Analysis System, National Health Accounts, and National Hospital Survey. These components all measure expenditures. BTS and CEAS collect data annually. The NHA is conducted every two years. The NHS is a periodic sample survey.

PHR benchmarks for 1999 call for the BTS to be integrated with the HIS. The HIS, BTS, CEAS, NHA, and NHS share some data needs, and use some of the same data collected by the HIS. In fact, 13 additional HIS forms were developed under the DDM project to collect data needed by the BTS. Unfortunately, these forms are not being used. HES and HIS data requirements should be integrated as much as possible. This will result in a single data collection system, simplifying training, equipment, human resource, and logistics requirements in the health directorates. It should also reduce duplication of effort.

BTS and CEAS are complex methodologies. As applied under DDM, they require some very detailed data. The BTS in particular requires an annual sample survey to estimate how medical personnel in multifunction units spend their time. If these data requirements are added to the current HIS, it may be more than is possible with the equipment and personnel available in the health directorates. It may be possible to simplify the most difficult parts of these two systems, without seriously affecting the accuracy of the results. The HES team should look for ways to simplify data collection and data processing requirements for these systems before integrating them into the HIS 2000 set of forms and database. Finally, the HES team should look for ways to modify these systems to better meet the needs of the overall health reform effort.

Objective

Review BTS and CEAS methodology to determine how it can be changed to better meet the needs of the health reform effort. Simplify HES data collection and processing requirements as much as possible. Integrate HES and HIS data collection, processing, and reporting efforts at the governorate level. Develop and execute an effective plan for testing and introducing HES data collection, processing, reporting, and use in governorate health directorates.

Tasks

1. Review HES methodology and adjust to meet current requirements.

2. Simplify HES data collection and processing requirements as much as possible.

3. Review DDM BTS/HIS forms and modify as needed.

4. Clearly specify the flow of forms and data, and the various processing tasks.

5. Develop an approach and specifications for integrating HES data collection, processing, and reporting into the HIS.

6. Develop additional database structures, queries, and reports necessary to monitor the completeness and quality of HES data.

7. Design and test HES management reports.

8. Design HES indicator displays to be added to the EIS.

9. Estimate the number of personnel required to train HIC personnel in the use of the forms.

10. Develop a realistic plan for testing and integrating HES data collection with HIS data collection.

11. Develop training materials for health directorate personnel who will collect and process HES data.

12. Develop training materials for managers who will use HES results in health directorates and the central MOHP.

Team Requirements

- Thorough knowledge of HES methodologies and data requirements
- Good knowledge of conditions and personnel in health directorates
- Familiarity with HIS forms, coding, and data structures

Related Training Courses

- Microsoft Access (Intermediate, Advanced)
- Structured Query Language
- Microsoft SQL Server (Database Design, Application Design)

Deliverables

1. An MS Access application making it easy to print HES data entry forms, enter data, and produce HES reports in governorate health directorates

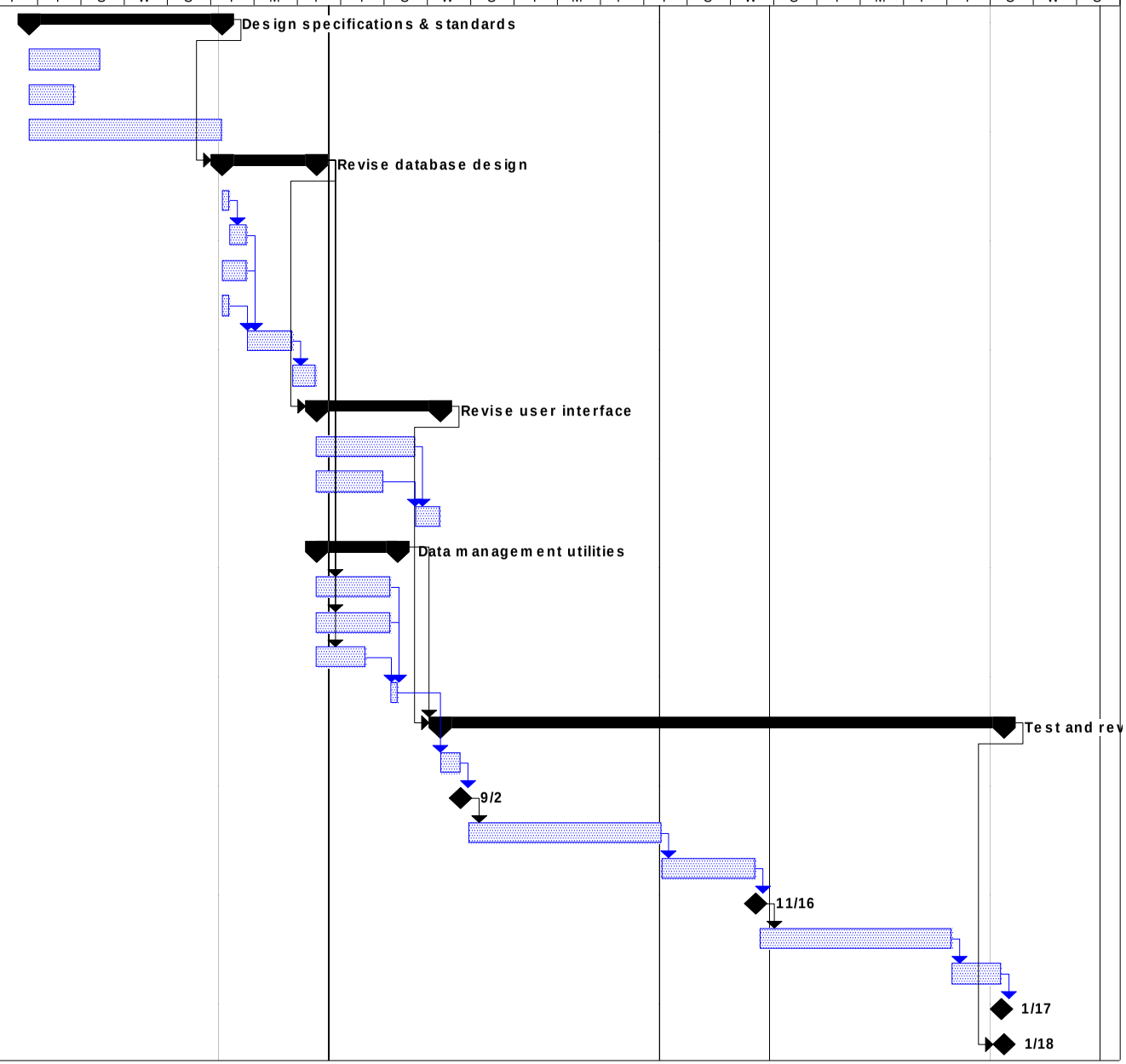
2. An easy-to-use facility for transferring HES results to HICs and to the NICHP

3. Technical documentation for the application described above

4. A user guide in Arabic designed for users in health directorate planning departments

Annex F. Draft HIS 2000 Work Plan

ID	Task Name	Duration
1	**Design specifications & sta**	**48 days**
2	Review and revise forms	18 days
3	Set validation standards	12 days
4	Set coding standards	48 days
5	**Revise database design**	**24 days**
6	Normalization	2 days
7	Relational integrity	4 days
8	Field/form validation	6 days
9	Design security (HIC)	2 days
10	Implement design	12 days
11	Design testing	6 days
12	**Revise user interface**	**30 days**
13	Update data entry screen	24 days
14	Update reports	16 days
15	Update menus	6 days
16	**Data management utilities**	**20 days**
17	Develop data conversion	18 days
18	Develop data consolidatio	18 days
19	Develop backup/archiving	12 days
20	Integrate utilities w ith UI	2 days
21	**Test and revision**	**141 days**
22	Alpha testing (NICHP)	6 days
23	RC 1	1 day
24	Beta test 1 (3 gov, MOHP)	48 days
25	Revision	24 days
26	RC 2	1 day
27	Beta test 2 (3 gov, MOHP)	48 days
28	Revise	12 days
29	HIS 2000 RTM	1 day
30	Begin deployment/migration	1 day



ID	Task Name	Duration
30	Begin deployment/migration	1 day
31	**Update EIS application**	**85 days**
32	Design indicator displays	12 days
33	Design UI structure	3 days
34	Develop and test queries	6 days
35	Implement indicator displa	6 days
36	Update UI (Arabic)	4 days
37	Alpha testing (NICHP)	3 days
38	EIS RC 1	1 day
39	Beta test 1 (3 gov, MOHP)	24 days
40	Revision	12 days
41	EIS RC 2	1 day
42	Beta testing 2 (3 gov, MOI	12 days
43	EIS RTM	1 day